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[Communicated.]

Lighting Fixture Manufacture of To-day.

The study of this subject, when attempted in its many phases, will soon be found a big task for mastery, in that it has as many phases as its exponents have different opinions; but. after all, can we say that we really have modern fixtures to-day? For strange as it may seem, either from an artistic or scientific standpoint, there is to-day no modern fixture, either gas or electric. Positively the electric fixture of to-day is the gas fixture of yesterday, adapted, of course, to the new form of energy. Nevertheless, after a study of the subject, the type of to-day is the same fixture in principle that was used in the times of our grandfathers, yes, of our great grandfathers, in whose palatial mansions oil lamps were hung from chandeliers, which chandeliers were later transformed to act as the carriers of gas burners. Then, later, with the introduction of the electric incandescent light, this very same fixture was again transformed into the electric lighting chandelier. And if, willy nilly, some of the fixture manufacturers are allowed to keep on their even way, there will be nothing else on the market than chandeliers of the electric lighting sort.

The transformation has been witnessed no doubt by many readers of the JOURNAL, and the recollection of the chandelier with the oil lamp is still fresh in many memories.

To substantiate the fact that there has been no progress in the general design or principle of the fixture, from the period of its inception to the present day, let me take up briefly the origin and history of the fixture as the records have preserved these.

We are told that primitive man first secured the fire or light that he needed in his cave dwelling by rubbing two pieces of dry wood together untill ignition resulted, and this fire was either used to ignite the fuel used for heat or for the brand or torch used for illumination. The torch, in all probability, furnished the first example of interior as well as exterior illumination. Fibrous bark, soaked in animal fat, was the progenitor of both the candle and the oil lamp. The ancient lighting lamp consisted merely of a shallow bowl for holding the oil, having one or more spouts or nozzles, with openings large enough to receive a wick.

The first mention of any fixture for lighting appeared about 1,500 B. C., when is recorded the use of the candlestick as part of the furnishings of the tabernacle, which Moses was directed to build.

The fixture originally was known, and is properly called, a chandelier; *i. e.*, candle support. Having progressed to the stage where the utility of the oil lamp became practical for general use, it became necessary to find a support for the lamp. Now, there were two ways of supporting a light source, either from underneath or by suspension from an overhead support. The overhead support may either be from the roof or from an arm projecting from the side of a wall or post. Four methods were developed during the very earliest period for placing light sources, namely:

First.—Portable lamps, having no specific place for their support, now known as portables.

Second.—Lamps supported by standard or columns, now known as candelabra or standards.

Third.—Lamps suspended from ceiling, now known as chandeliers or fixtures.

Fourth.—Lamps suspended from, or resting upon, some projecting support from side walls or posts, now known as brackets.

These four methods are in reality the foundation of all fixture construction. No matter how simple or how elaborate the design, the principle is ever the same, and while some art may be embodied in carrying out a particular design, the fixture, of whatever type which possesses this so-called gingerbread, should be discarded. One fact often lost sight of is that the lighting fixture is not an integral part of the building, so by far the larger majority of architectual designs, based upon models furnished by the ancient periods of civilization, do not embody fixture designs. None of the periods of architecture named herein have any designs in fixtures which are fitting to the architectural lines embodied—namely: Egyptian, Oriental, Chaldean, Assyrian, Greek (Doric, Ionic. Corinthian), Roman (Tuscan-Composite), Byzantine, Romanesque, Gothic, Renaissance—none of the nations who originated these designs in architecture made any use of artificial light worth mentioning, and consequently were not designers of lighting fixtures. Whatever artificial light needed was furnished by either a portable type of lamp or one supported by standards or columns.

The development of the chandelier designs progressed during the period and time that marked development of interior decorations, and several fixture designs are sequels to these periods. The oldest forms of chandeliers were constructed in the shape of a circular band, ar-

ranged to support a number of light sources or units, either candles or lamps, and this band was supported by three or four chains from the ceiling. From this primitive design the corona chandelier was evolved, which types of chandeliers were used in illuminating the earliest mediaeval churches. Some of these chandeliers attained very large proportions and were worked out in most elaborate way; but the elaborate specimens of these were confined entirely to churches. Of a certainty, residence lighting was still of the simplest kind.

In the Fifteenth Century chandeliers of wood were first developed, being constructed of wood in simple manner by placing boards cross wise, with a center support from above, candles being placed on the ends. About this time the chandelier found its way into the dwell ings of the aristocracy. Beautiful specimens, made of carved wood in combination with wrought iron, were the development of the period. Old manuscripts show specimens of Venetian, German and Flemish designs in metal, which are remarkable as to detail of finish.

The following quotations from some old records will be apropos here: "From this time on the artistic chandelier was developed in different countries in Europe. The leadership, not only on the design of the fixtures themselves, but in their treatment as part of the decorative schemes, has always been taken by France. During the Seventeenth Century oil was practically a department of State in that country, and was dominated by the master mind of the great Charles DeBrun. His was the golden age of decorative art and the lighting fixtures of all kinds designed during this period remain as master pieces to this day."

These magnificent creations, however, were found only in the palaces and chateaux of the nobility or wealthy, and in the churches. The chandelier of the simple design and order only was used for residence lighting by some of the people of moderate means.

The invention of the lamp, with a circular wick and glass chimney by Argand (1782) was the real improvement as the means for producing light for general uses that have been made since prehistoric time. The candle of to-day gives no better light than it did in the time of Moses; but the oil lamp of Argand, with its brilliant, smokeless flame, was an enormous improvement over the yellow flame of the old-fashioned oil lamps, and its innovation must have been received with a greater welcome than was the introduction of the Welsbach light over the yellow, open flame.

While writing of candles, it might be well to note that even in these realistic modern times, more candles are made and used to-day than in any prior day or time. With the introduction of gas (now virtually 100 years ago) came the opportunity for the development of interior and exterior illumination on a commercial basis. The first gas "fixture" was the bladder which that versatile man and great inventor, William Murdock, employed to give his demonstration in England in 1792. Gas was first introduced for commercial use in England April 30th, 1812, and during the same year in the United States, at Newport, R. I. The fixture used at the time was very crude in construction, but as gas came more in general use the ingenuity of man soon conceived the idea of feeding the gas to the chandelier through hollow tubes. This marked the transformation of the chandelier into a gas fixture, or gas chandelier as it was called.

When the incandescent electric lamps became practical (February, 1878), the designers merely ran wires through the pipes that supplied the gas, simply substituting the electric lamp for the gas burner; and so, even to the present time, there has been no marked divergence from the principles of construction and design that were in vogue before even illuminating gas was known, or when candles afforded the highest type of artificial light produced.

Generally speaking, very little has been developed that is essentially electric in lighting fixture construction, since by far the larger number of designs, right up to the present time, are only adaptations of the designs that originated in France 200 years ago.

While very little has been done to establish any new school of art which might afford some new designs in fixtures, still less has been done to improve the gas fixture mechanically, and only few of the present types of gas fixtures are adaptable to the modern lighting units on the market.

The main innovation of recent years in establishing anything new in decorative design is the school of decorative art, which takes its name "Art Nouveau" *per se* from the French. This system has, so-to-speak, become familiar to many as constituting a particular form of house decoration; and in Europe it has been taken up quite generally by the designers of lighting fixtures. The fundamental motif of this school of art appears to be the adopting of the graceful curves found in vegetation, particularly that of tropical origin, with a more or less faithful adherence to nature in the use of these curves rather than their reduction to conventional forms.

The *art nouveau* fixture has not received much recognition from American manufacturers. In the East they have been very slow in adopting this art design, although in the West it has been taken up to some extent. Like many other innovations this would seem to prove the West more progressive than the East.

The introduction of the Welsbach mantle brought an awakening to the gas industry which has kept it ahead of the electric light to current time. The upright burner was easily adapted to any fixture, but the introduction of the inverted burner called for a change in construction. Here, again, the fixture manufacturers were slow to grasp the opportunity to do something, and it was not until some of the inverted burner manufacturers were forced to take up the manufacture of fixtures themselves, in order to secure harmony in construction and design, that some of the separate fixture manufacturers really strayed from the old and beaten path, to put some fixtures on the market adapted for inverted burners. But even at the present time fixtures for inverted gas burners are limited, some manufacturers declining to go into their production. However, fixture manufacture must undergo a radical change in construction in order to come up to the conditions of to-day, and it would seem up to the gas companies to set the standard.

Ugly as some of the fixtures are, more of disquiet is added to the situation by placing such appurtences on the fixtures as goosenecks, even to having stove connections at the burner outlets, when it is a simple matter to construct a gas-way through the bottom of the body of the fixture, which is more practical and which preserves what lines of art the fixture might have, leaving all the burners available for what they were intended—namely, the yielding of light.

From personal experience the writer knows full well that it is a difficult matter to arouse these manufacturers from their slumbers to the point of bringing about anything new or markedly differing from that shown in the gas fixtures of the past. Indeed, one manufacturer, when approached in reference to adopting the method of putting the gas-way through the body of the fixture for a gas portable, gas percolator or gas chafing dish, objected strongly on account of the additional expense of building a fixture in the proposed manner. Let me ask, what license has he to register such objection? Doesn't the customer pay for everything that he gets which saves time and labor for him, or adds to the utility of any device in common use? At the present time this manufacturer has a fixture on the market constructed in this manner; but if you like some other fixture that he manufactures, and desire the noted attachment with it, you cannot have it. The answer it would seem is that it is right up to the gas companies to demand the changes be made, and insist on getting them in the fixtures they purchase; and surely the gas companies buy sufficient fixtures to be able to dictate the construction of these wares.

Architects or builders do not make demands on the future manufacturers for any change in the construction of such. They simply adopt those on the market nearest to meeting their requirements, but really giving to this part of the interior furnishings their last consideration, or at the time when usually little money is left to purchase fixtures which should harmonize with the rest of the design or decorations to be carried out. So, under stress in the majority of cases, he gives his preference to the electric light company by installing electric fixtures, and the gas man permits him to get the business, present and subsequent.

(To be Concluded.)

(Continued from Vol. XCIX., Page 40.)

Report of Committee on Progress in Carbonization Methods.[1]

[Presented at the Eighth Annual Meeting, American Gas Institute.]

United Gas Improvement Vertical Retorts, by Mr. J. H. Taussig.—The work of this Company during the past year on verticals has been confined to experiments with its plants at Manchester, N. H., and Northern Liberties, Philadelphia, Pa.; also the design of the new installations now in course of erection at Hartford, Conn., and Fall River, Mass.

The settings at Manchester and Northern Liberties are similar in general design and have the same size retorts.

1. Slightly abridged.—Eds.

Figs. 11, 12 and 13 are of the Northern Liberties plant; Fig. 14

Fig. 11 —Northern Liberties Vertical Plant, U. G. I. Co.

Fig. 12.—Northern Liberties Vertical Plant, U. G. I. Co.

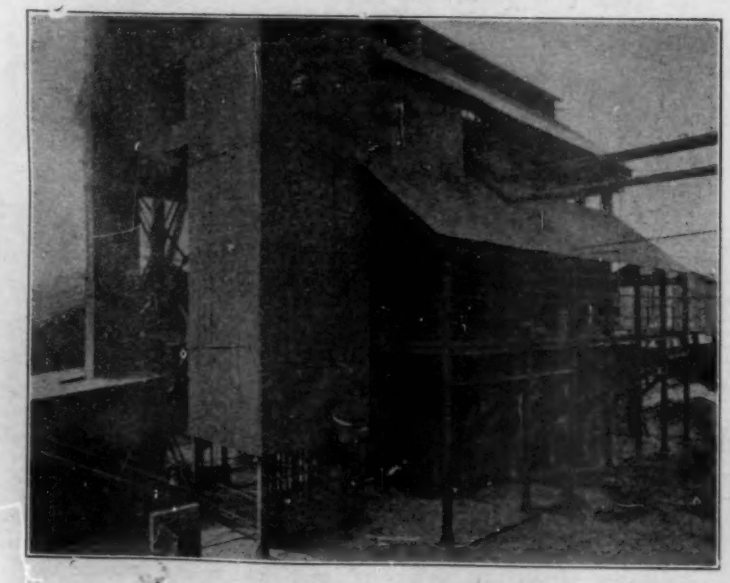

Fig. 13.—Northern Liberties Vertical Plant, U. G. I. Co.

shows the Manchester setting. Although both these settings give excellent manufacturing results, a number of improvements are being made. At both plants trouble has been experienced with leakage at the lower retort doors. At Northern Liberties trouble has been experienced with firebrick material, while at Manchester the retorts are

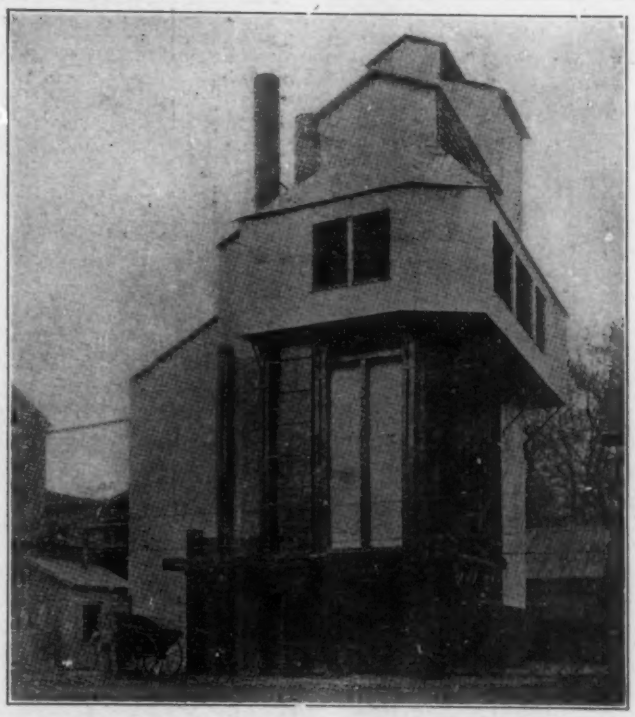

Fig. 14.—Vertical Plant, U. G. I. Co., Manchester, N. H.

still in operation after 1,100 days working. The latter are of foreign material fabricated in this country, while the Northern Liberties material is domestic.

The important new features in the Hartford and Fall River installations are the size of the retorts and the lower mouthpiece construction. Our present plants have retorts 15½ by 21½ inches, at the bottom, 10 by 14 inches at the top, and 18 feet 6 inches long. Under normal conditions the charges burn off in from 8 to 9 hours. The new retorts have the same taper, are 18 by 30 inches at the bottom, 12 by 22 inches at the top, and 18 feet 6 inches long, and when filled to about 4 feet from the top (the space usually allowed for fixing the gas) hold about 1,650 pounds of coal; the Manchester and Northern Liberties retorts hold about 950 pounds. We have tried, experimentally, a retort of even larger dimensions which showed great promise.

As our European friends seem to have very positive ideas as to how large an intermittent retort should be, it might be well to enumerate some of the advantages we think should be attained with our new design. These are:

First.—Completion of carbonization simultaneously at all heights of retort; obtained by enlarging the upper section in proportion to the exposed heat. By this, back pressure on lower mouthpieces is reduced, and there are possibilities for better bench fuel economy and for better gas making results.

Mr. O. B. Evans shows in his paper that there is considerable pressure on the bottom mouthpieces at one period in our present retorts. This pressure, it is demonstrated, is due to the coking of the upper section of retort before the lower section. The tests give us confidence that enlargement of retorts is a move in the right direction.

Second.—Uniform discharge of coke: This will discharge from a small retort only when thoroughly carbonized. Experiments show that it will discharge from a large retort when not thoroughly burned off, due probably to the extra mass of material.

Third.—Labor economy: A series of 3 large retorts can be discharged and charged as readily as 3 small ones. In many cases where 8-hour shifts are employed one shift can be eliminated, if charges are dropped in 12 hours, which is expected to be the length for the new design.

Fourth.—Large coke: This may not be an advantage in all situations, but it is in many. The new departure in lower mouthpieces is a take-off and auxiliary hydraulic main. With a large retort, and uniform carbonizing, this may be unnecessary, but it will give considerable leeway in the physical character of coal used, and will enable the operator to run on even gauge at the bottom mouthpieces, reducing leakage.

Other features incorporated in our plants of latest design include a waste heat boiler, new heating system, coke and coal handling.

Fig. 15 shows a typical section through the retorts; Fig. 16 is a

typical plant, handling coke and coal by means of gravity bucke conveyor; Fig. 17, method of measuring primary and secondary air in conjunction with the CO_2 return system.

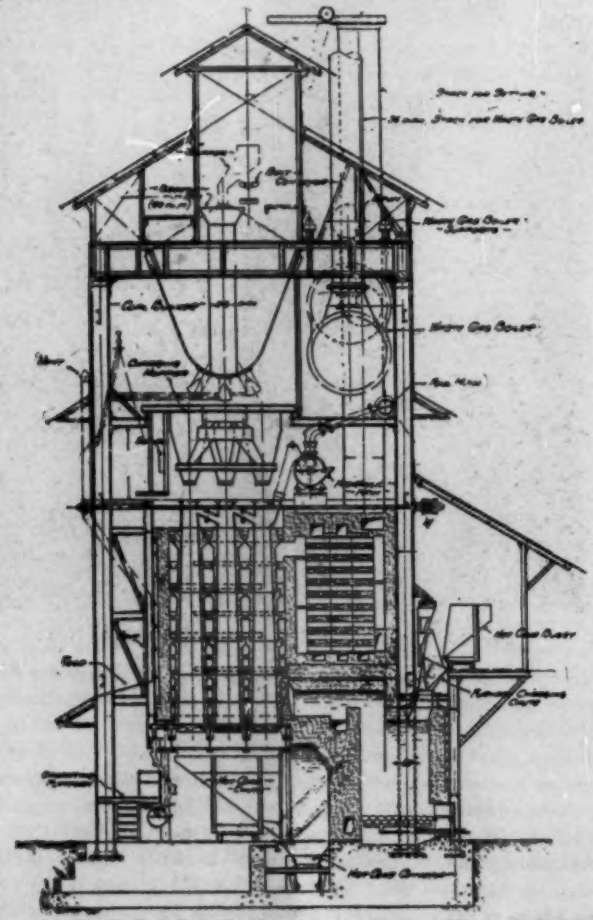

Fig. 15.—The U. G. I. Co.'s Vertica Retorts (Sectional View), Philadelphia.

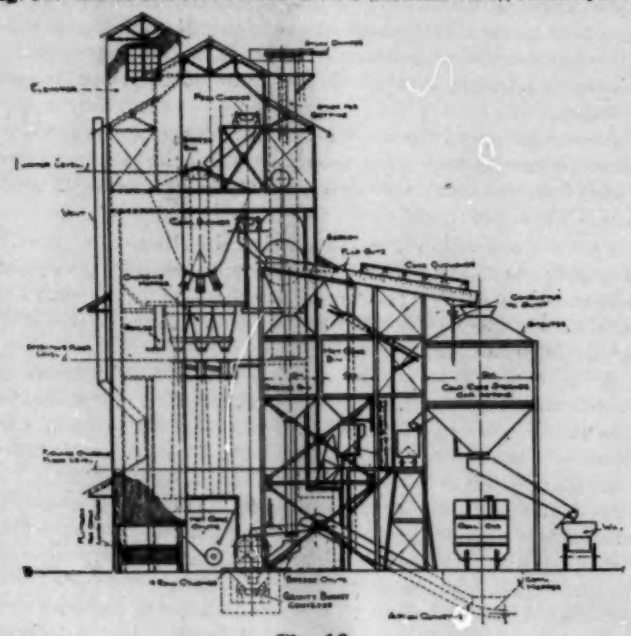

Fig. 16.

At Hartford the coal and coke will be handled as shown in these cuts. The coke will be discharged from the retorts into a cast iron chute, and by a drum fed to the conveyor. The chute serves for storage if the conveyor is out of commission.

The conveyor elevates the unquenched coke and discharges it on a shaking screen, after which it passes into the brick lined, hot coke bin, or on a shaking table where it is quenched and then into the storage bin.

The hot coke bin is situated above and near the furnace charging platform, so that hot coke can be drawn into a car, weighed, and wheeled to the furnaces for producers. As the water gas operating floor is on the same level the car can be wheeled to the generators and the coke used hot.

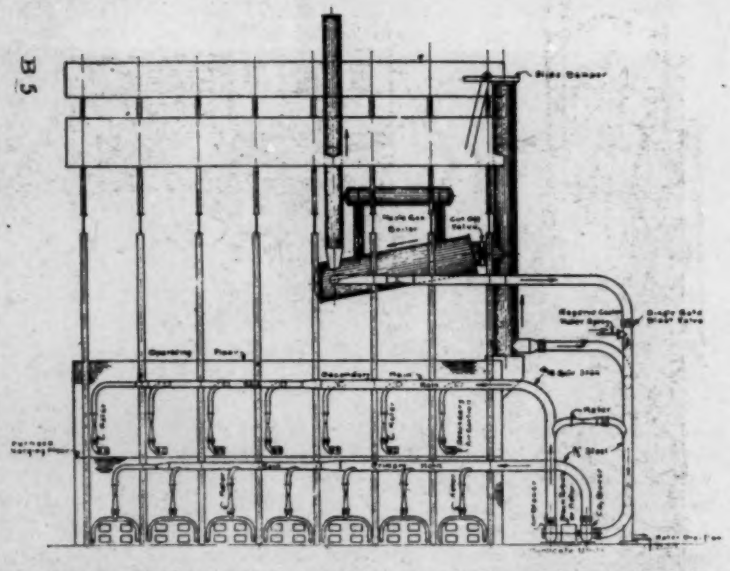

Fig. 17.—The United Gas Improvement Company's System for Measuring Primary CO_2 Mixture and Secondary Air for the 18 Ft. by 20-Inch Vertical Retort—1913 Type.

The breeze, passed dry from the bin into the conveyor, is taken to the bins above the retorts for use as stoppers.

The coke is taken up by the same conveyor, but in larger plants a separate coal handling system would be provided.

The Fall River plant will use a DeBrouwer conveyor for handling coke and a belt conveyor for coal, and will also have a building independent from the buckstays. Both plants will contain 7 benches of 9s, with a capacity of slightly over a million cubic feet per day, and are equipped with blowers to blow into the setting the primary mixture (CO_2 and air) and secondary air, through meters.

Continuous Vertical System.—This system is now well past the experimental stage, many plants being in successful operation abroad, and in this country a Woodall-Duckham plant at Derby, Conn., and a Glover-West plant at Fitchburg, Mass. Plants of the Glover-West type have been contracted for in Montreal and Ottawa; Portland, Me., and Pawtucket, R. I.; Woodall-Duckham plants have been contracted for in Schenectady, N. Y.; Brockton, Mass.; New Haven, Conn.; Holyoke, Mass., and a second installation at Derby, Conn.

The present status of the continuous system is well presented in the two reports which follow:

The Glover-West System of Continuous Vertical Retorts.—Report by G. A. Balz, Didier March Company.—Carbonization of coal has passed through various stages, from the old style, stop-end, horizontal retorts, to the through horrizontal and inclined retort, and finally to the vertical retort. Gravity handling of the raw material, and discharge of the coke from the retorts, have been greatly simplified. The next step in the development of the vertical retort was toward uniform quality and quantity of gas produced. This object has been attained in the continuous vertical retort. The Glover-West system was first shown as an accomplished fact at the installation, St. Helens Corporation gas works, in England. This original installation contains several interesting features in design, has been in operation since October, 1908, and is still giving excellent results.

In the Glover-West system the retorts are heated by separate and distinct combustion chambers, overlying each other throughout the height of the retorts, and, by means of dampers, the heating in any length of retort can be varied at will. By this convenience of regulation almost any character of coal can be successfully carbonized. The method used to recover the heat remaining in the coke is undoubtedly unique in the construction of retort settings.

The principal parts of the apparatus (Fig. 18) are as follows: A coal bunker; coal feeding hopper; retort setting, comprising a producer, secondary air heating chambers, combustion chambers and waste gas circulating chambers; coke extracting worm; driving gear for the coke extractor; coke chamber with hermetically sealed door.

The coal bunker is supported on steel girders and columns attached to the heads of the buckstays. It is of steel plates stiffened by angles and bracing, and extends the entire length of the bench, with outlets corresponding to the retorts which it is to serve. Each retort is provided with an individual feeding hopper, with rotary feed valve.

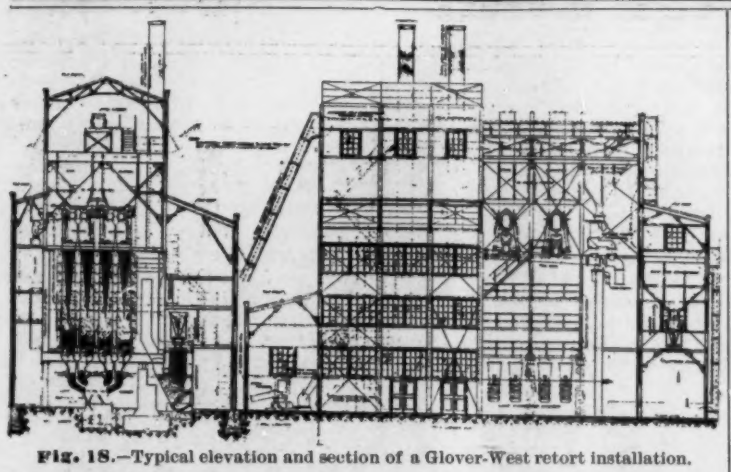

Fig. 18.—Typical elevation and section of a Glover-West retort installation.

Each setting has a steel chimney, lined with a firebrick, supported on the bench. Each retort is fitted with a Glover-West coke extractor, with a safety device to prevent breakage in the event of an accidental overload.

The coal is supplied to the feeding hopper above the retort and falls, by gravity, to the retort and through it to the coke receiving chamber.

The coal, on passing through the heated retort, is completely carbonized, and the residual coke extracted by the worm revolving slowly at the base of the retort, the speed of the worm regulating the speed at which the coal passes through the retort. A regulating device enables the operator to regulate the speed at which a charge travels, and the temperature of the retorts can be regulated by the various dampers, provided for producer gas and air. The coke discharged is temporarily received and stored in the coke receiving chamber. As it accumulates, it is periodically discharged through a self-sealing door to a coke buggy or other apparatus for transporting it to storage or to the coke separation plant. Extracting the heat from the outgoing coke and utilizing it for preheating the secondary air enable the attendants to perform their duties without inconvenience by smoke, steam or fumes, which arise from coke when quenched by water.

The heat, transmitted through the walls of the retort to the charge which is passing through, first attacks the outer surface of the charge. It is obvious that, if the charge remained stationary, the heat would penetrate it entirely. This is prevented in the Glover-West system, as the coal is continuously in motion downward, and in its progress through the retort, the coal is completely carbonized. The time necessary for carbonizing the coal, to a state when it is inadvis able to continue the removal of the lean gas, can be regulated by adjusting the speed of the discharge of the coke, and enables the plant to be readily adapted to any kind of coal without interfering with the routine of the retort house.

The Glover-West setting is so designed that it consists essentially of 2 units, each containing 14 retorts. Complete independence of the units is obtained by means of 2 main, producer gas flues. In the earlier settings which are especially adapted to small works, the retorts can be operated in units of twos. This range of output enables the smallest works to have the advantages of the vertical retorts.

The American Gas Light Journal (June 16, 1913, page 393) published an interesting article describing vertical retorts in a small gas works, in this case referring to the Lurgan (England) Gas Light and Chemical Company, which installed a bench of eight Glover-West verticals to replace the old horizontals. The operation of the plant has been entirely satisfactory under all fluctuations of demand. The retorts are heated by 2 producers, each producer serving 4 retorts, so arranged that any retort can be cut out by dampers. Members are referred to the article in question for a further description and the general arrangement of the plant.

The fact that the entire structure of the retort setting is practically in compression indicates that the retorts will have a long life, the vertical position being an ideal one for a retort, the temperature of the retorts being more nearly constant than with the intermittent systems, in which the retorts are frequently opened and subjected to rapid cooling. The original retorts at St. Helens have been working over 1,000 days, and give promises of working a further extended period. In other directions minimum wear-and-tear of plant may be expected. The coke is discharged from the coke chambers, cooled, and hence is not so destructive to the handling plant.

Again, as the principle of the operation of the Glover-West system depends upon the natural gravitation of the coal through the retorts, the mechanical operations are few in number, with a minimum risk of delay through breakdowns of machinery. Reserve driving-equipment for the coke extracting mechanism is provided, which practically eliminates shutdown from mechanical causes. (Fig. 19.)

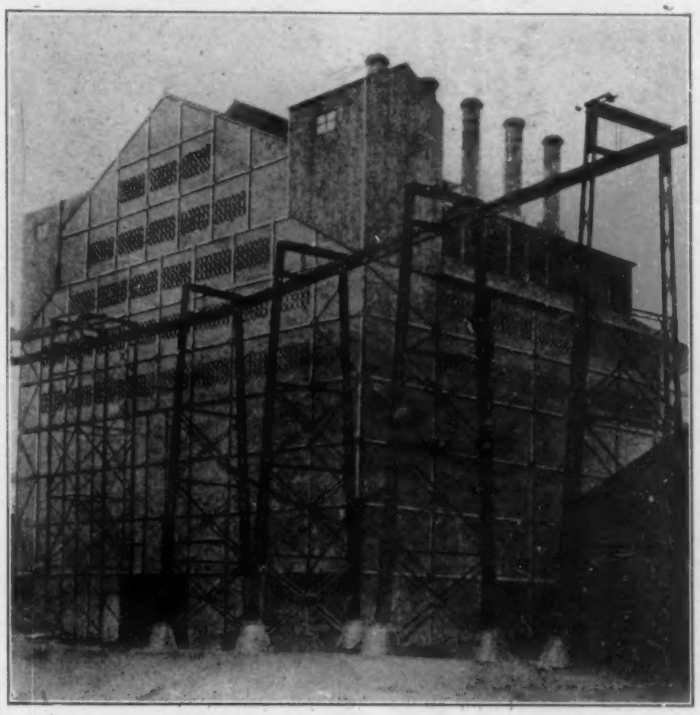

Fig. 19.—Belfast Retort House, G.-W. System.

The recent extension of the carbonizing plant of the Belfast Corporation is one of the latest foreign installations of the Glover-West system, and consists of 10 benches of 8 vertical retorts, having a capacity of 2,500,000 cubic feet of gas per 24 hours.

As the installation occupies less ground area than is required by plants of the horizontal and inclined systems of like capacity, it was possible to eventually replace the old horizontal plant by a vertical installation that increased the producing capacity of the works, avoiding the necessity of acquiring a site for a new works to meet the city's increasing demand for gas. The carbonizing plant is conveniently located near a coal store, opposite the gable end of the retort house, the store supplied with coal by light railway wagons on overhead tracks, which also supply the entire storage of the works. The 2 stacks of benches are arranged in 2 rows of 5 benches, parallel to each other. The coal is taken from storage by 2 lines of equipment, one for each stack, comprising a coal hopper, from which the coal is received and fed, by a reciprocating feeder, to a coal crusher. This feeder has a screen to enable small coal to be fed to the conveyor without passing through the crusher; a West's crusher, with two pairs of cast steel rolls, and a coal conveyor of the gravity bucket type. From this conveyor the coal is discharged into the storage bunkers, above the benches, and running their entire length. Each unit of coal handling plant has a capa city of 50 tons per hour, the capacity of the storage bunkers above the benches being sufficient for a 48 hour supply to the retorts. (Fig. 20.)

Above each retort is a coal feeding hopper which receives its supply from the opening in the coal bunker immediately above it. This hopper contains about 3 hours' supply to the retort, and is fitted with a rotary coal valve through which the coal is continuously descending, and it is completely carbonized by the time it reaches the base of the retorts. When converted into coke it passes through the lower ends of the retorts, and is cooled by air which circulates around the bases of the retorts, which heated air is forming the secondary air supply to the combustion chambers that are arranged in horizontal super-imposed floors, each floor being distinct from the others. (Fig. 21.)

The producer gas, supplied from a generator common to the 8 retorts of the setting, rises through vertical flues and is admitted to the several floors through tuyeres controlled by dampers. The waste gases from each combustion chamber are led through flues and circulating chambers around the top-ends of the retorts, later making their exit to a chimney, of which there is one to each setting.

The gas made ascends in the retort to an outlet at the side of the coal feeding hopper, and is led through the valve to a condensing

Fig. 20.—Coal Bunkers and Feeding Hoppers, G.-W. Benches.

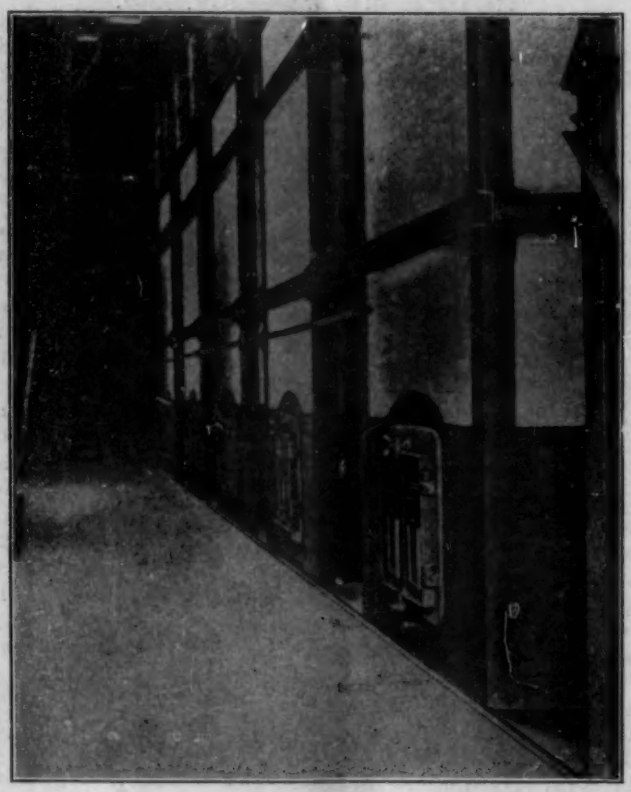

Fig. 21.—Producer Side, G.-W. Benches.

main, having gas and tar outlet valves. From this main the gas and tar are taken through the foul main, provided with a retort house governor having the usual by-pass with valve connections.

A lift is provided for each stack, which serves the purpose of raising the coke required for the producers, and is also used for raising the coal for filling the retorts when they are first placed in service and after they have been scurfed. These lifts also serve as auxiliary coal elevators in an emergency. The retort house consists of a light, steel frame, filled in with a screen of light brickwork, with openings left for doors, windows and ventilators. The roof is constructed as part of the main building frame and is of slate. The entire equipment is electrically driven by separate motors in several sections of the plant, the motors of the coke extracting driving gear being in duplicate.

Statement by Mr. J. S. DeHart, of the Isbell-Porter Co.—The principle of this system is the *regulated, continuous descent* of coal through a suitably heated and constructed vertical retort, the speed of descent so regulated that the coal entering at the top is gradually carbonized in its passage through the retort and converted into coke by the time it arrives at the bottom. As it descends the various gases and by-products are evolved as the coal reaches the necessary temperature, and the gases ascend and are taken away from the top of the retort. This process is one of fractional distillation, the heating being most intense around the upper part of the retort. The weight of coal fed to the retort and the rate at which the charge descends are both governed by the rate of extraction of the coke from the bottom of the retort.

The first Woodall-Duckham patent to set forth the principle of the continuous discharge of coke from the bottom of the retort governing the automatic feed of coal to the top was obtained in July, 1903, the first commercial plant being erected at Bournemouth in 1906. Fig. 1-W shows the general construction of this plant which had a

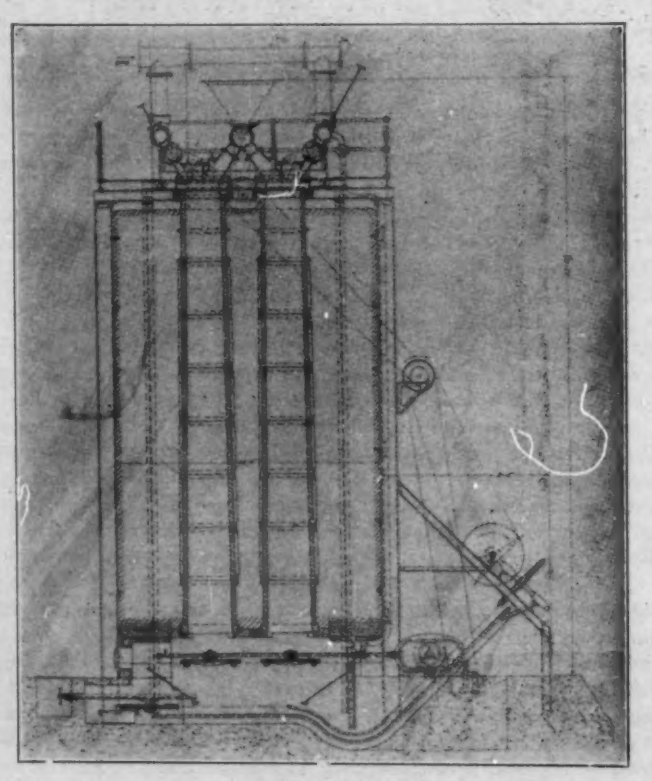

Fig. 1-W.

water seal at the bottom engaging 4 retorts. It included coal charging valves and coke reciprocators and conveyors, all actuated by power, the machinery being very complicated and sure to fail when most needed.

In 1908 Messrs. Woodall-Duckham patented their present coke discharger, which is the most important factor in the continuously working retort, and the form then adopted has given perfect satisfaction and is used to-day in all their installations. These retorts were elevated and supported on steel stanchions to give free access to all working parts; coal magazines and coke hoppers were provided below the coal valve and above the coke valve, both of which are now operated by hand, power being used for the coke extractors only.

Later the producers were elevated. Light and ventilation are secured by this construction and it has been followed in all later construction. The ashes as well as the coke installations are allowed to fall by gravity to the basement floor or to a vacuum recovery system. Fig. 2-W is a cross section of the Derby, Conn., installation built with the oval retorts, and in which the coke is handled with narrow gauge car.

Fig. 3-W shows general arrangement of the Brockton installation in which the coke is handled by carrier conveyor, coal being taken at one end of the house and coke for sale delivered at the other end. Coke for the producers and coal for the retorts are carried in overhead bins, and coke for sale in a 16-hour night bin sufficiently above grade to deliver to a sizing and screening plant by gravity.

All coke is discharged cool and dry from the hoppers, without water quenching. Fig. 4-W is a cross section of the Schenectady installation in which the night storage and sizing plant are moved away from the retort house to make room for a duplicate carbonizing plant, and in the meantime to provide coke storage from which the coke may be reclaimed to the night storage and sizing plant by the conveyor.

The mechanically operated coke extractors soon led to the adoption of mechanically operated shaking grates for the furnaces. Hot air saturated with steam from waste heat boilers is used under the grates, and the ash is fine and free from clinker and coke. Fig. 5-W shows the construction of the shaking grate operated by a shaft, and the opening in the ashpan for the discharge of ashes to the basement.

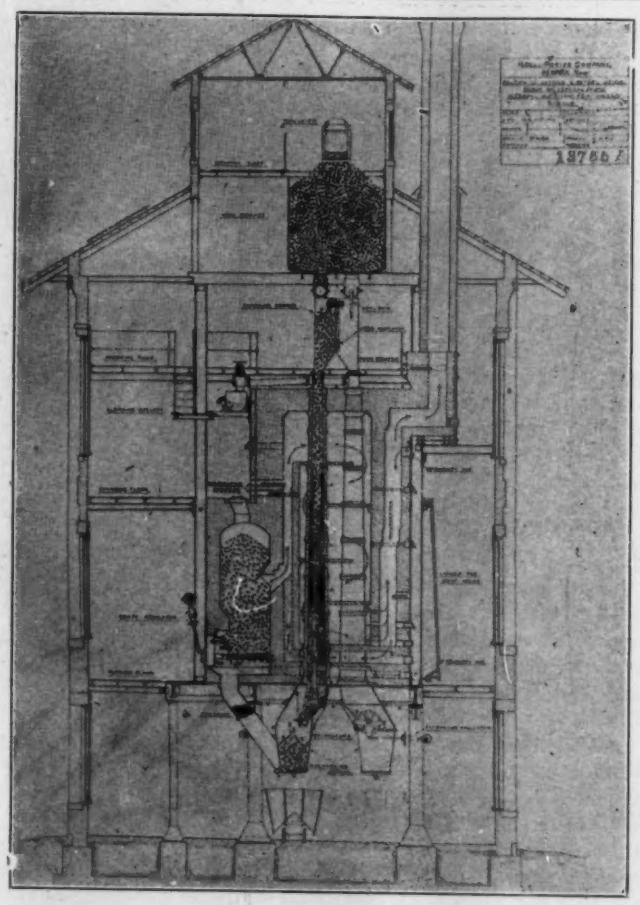

Fig. 2-W.

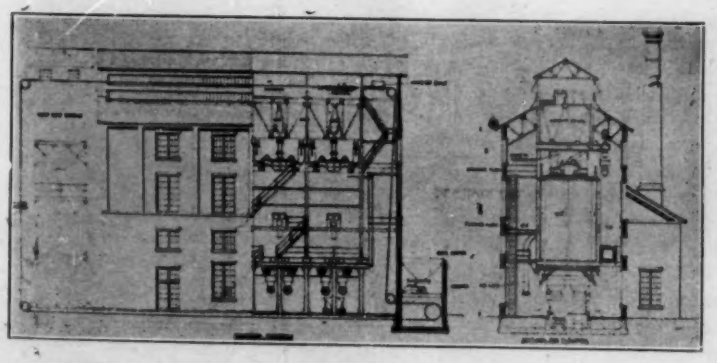

Fig. 3-W.

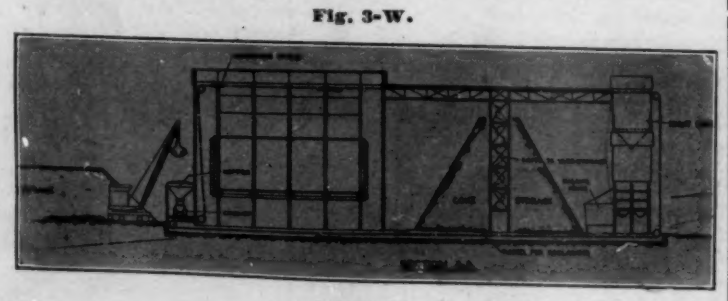

Fig. 4-W.

In 1910 the Woodall-Duckham Company patented their system of built-up retorts or ovens. These ovens have double the capacity of the oval retorts, being rectangular in section with practically the same taper and length as the oval sections. The settings are built with 2 or 4 retorts to a furnace with a capacity of 125,000 to 250,000 cubic feet respectively. Fig. 6-W outlines the built-up retorts for the 3½ million feet plant at Bristol, England.

In these settings the producers and recuperators are arranged between the retorts with straight joints in the brick walls so that any part of the setting may be renewed. Coal and coke bunkers, of 48 hours' capacity, are arranged above the retorts and producers, as shown in Fig. 7-W of the Bristol plant.

The coke from the large retorts has only 3 or 4 per cent. of breeze and, by a special treatment of the coal, the coke can be made suitable for foundry use.

English clays have a larger percentage of silica than American clays, and, if well burned, have very little shrinkage under working

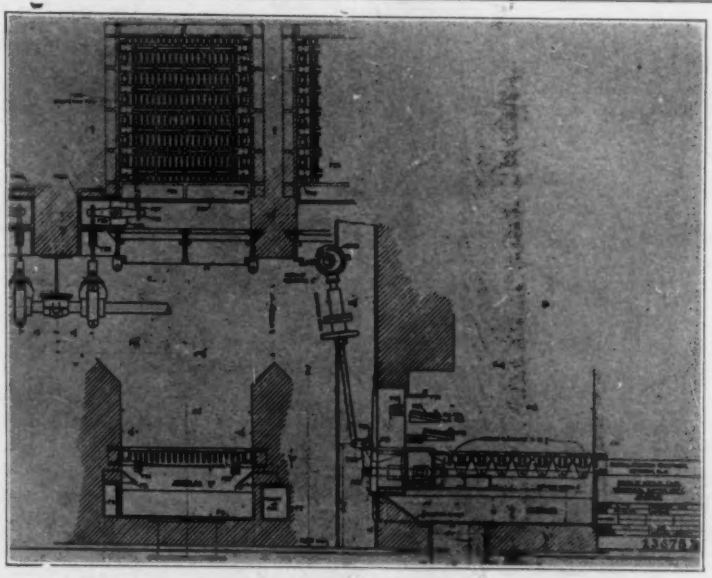

Fig. 5-W.

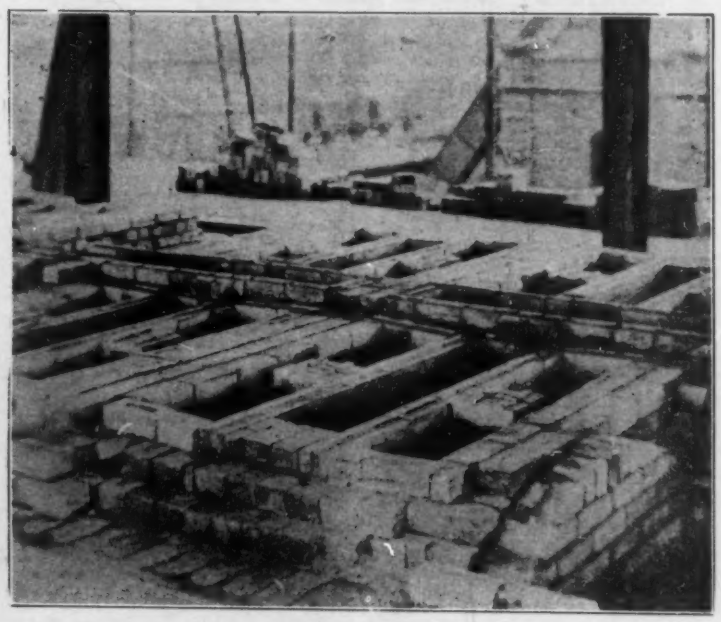

Fig. 6-W.

heats, and when finely ground make good tile for oven construction. American clays can have silica added and, if finely ground, make a fairly good tile. Such material, known as quartzite, will have very little shrinkage and possesses greater conductivity than ordinary clay. This was the material selected for the first vertical sectional ovens in this country in order to follow as closely as possible the English practice. In the meantime to compare this material with silica for conductivity samples of 96 per cent. silica brick and finely ground quartzite brick were furnished by the Harbison-Walker Refractories Company, and tested by the Bureau of Mines and the Massachusetts Technology Laboratory. The report from the Bureau showed that silica brick has 13·4 per cent. higher conductivity than the quartzite brick, and the Technology Laboratory finding shows they have 28 per cent. higher conductivity.

These tests were sufficient, in view of practical experience in coke oven construction, for us to adopt silica material in the upper combustion chambers and ovens of our settings, the latter being re-designed to provide for the necessary expansion of the silica material.

Temperatures above 2,400° are difficult to read with the naked eye, and in the average retort house this is the only instrument available The higher conductivity of silica and its smooth surface, to which carbon will not adhere, give a higher temperature inside the retort and make possible working heats which the average operator can judge without instruments. The shrinkage of highly refractory aluminous clays has done more to wreck settings than would a cheaper, non-shrinking clay with comparatively low refractory qualities. In vertical settings shrinkage is not serious if the bracing and cover tiles are arranged to settle with the retorts. Silica retorts will expand when heated, instead of contracting and expansion joints must be provided.

Silica is prepared from ganister rock which is ground and mixed with 2 per cent. of lime to give it a bond.

The Woodall-Duckham Company prepared to build ovens with a

(*Continued on page* 10.)

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NEW YORK, MONDAY, JANUARY 5, 1914.

BRIEFLY TOLD.

THE OLD YEAR AND THE NEW.—Our heartiest acknowledgments to our patrons are here tendered over the closing of a year that carried with it not a plethora of matters over which one could be truly thankful; that is, one engaged in the artificial lighting business. Our set returns for the twelvemonth show that the average gain in send-out, as compared with the immediately preceeding year, amounted to less than 6 per cent. In fact the percentage actually shown was 5.19. These test points numbered 28, and the list does not include any single company the output of which exceeds two thousand millions cubic feet per annum. The minimum sendout reported figures at 20 millions cubic feet; and all the points reporting are fairly representative of the entire sectional divisions of the country. This showing, everything having been given due consideration, is really a satisfactory one, for, without in any sense seeking to gain consolation from the lesser fortune of others, we doubt if any other of the great industries of the country can show a like return on their respective tradings. There is, too, the further satisfaction of knowing that the outlook for 1914 is vastly brighter than that which was concomitant with the forecast for 1913. At the outset of last year prices for enriching oil material were positively soaring, with the result that many proposed operations on new plants were put over. However, the following of strict economies, aided by the development of new oil fields, and the intelligent following of advanced methods in the caring for the older fields, eventually brought prices towards the close of the fall to figures that were rather more reassuring; although the prices are even now not remarkable for their lack of ascension. Naturally, this shift called the attention of engineers to a further development along purely coal gas lines, which steps were all the more easily taken through the advancement of mantle burners in respect of illumination, and from the knowledge that the gaseous heating values were much more readily maintainable under coal gas methods. This further illustrates the fact that, positive as the steps are that have been taken in the direction of substituting heat value instead of illuminating power as the legal standard, these will be far outpaced in like direction during 1914. Of a verity, this is positively the greatest development in the gas industry for the twelvemonth. Of course, no great advance was ever recorded that was not marked by stumbles, and one of these came in the shape of the celerity with which the coal barons advanced the price per gross ton. However, of such is trading composed. To say a word or two about ourselves. This number marks the attaining of our hundredth volume, and of our entrance to the latter half of our Fifty-Fifth Year. To our friends (and many it is our good fortune to have) we would say, in wishing them all the prosperity that it is possible to gain, that the plan of principle and practice that guided the JOURNAL in the past will continue to be our standard. Our object is to honestly aid the profession in the advancing of the great work which it performs to the public, in lighting the highways and the byeways, to the citizens in the betterment of the conditions that personally appeal to them in their factories, shops and homes—of a fact from the greatest of the former to the humblest of the latter. We repeat the expression of goodwill and our hope of good fortune during the year 1914.

PUBLIC STREET LIGHTING, PHILADELPHIA, PA.—Not until Monday, December 29th, did the Welsbach Street Lighting Company and the authorities of the city of Philadelphia come to an understanding over the question of the further lighting of the city's alleys and outlying streets. The Lighting Company's bid of $32 per lamp, for 1914, was not accepted by Director Cooke, who claimed that the prices on gasoline account were lower that those of a year ago, wherefore the figures of the bid were not justified by present conditions, and asked for a price at which the city could purchase the lamp tops, so as to operate them direct. President Shaw, of the Street Lighting Company, then proposed, as time was so short, that the present contract be extended for two months, which proposition was accepted. All the correspondence between these heads has been published by means of advertisements in the daily papers, President Shaw feeling that his stand was justified. Director Cooke's last communication was this: "If the extension of the present contract could have been made for 6 months, instead of 2 months, it would probably have afforded the city an opportunity to get competition for this work and relieve you of the necessity of continuing it under specifications that are not in every way satisfactory to you, or, better still, it would have enabled the city to manufacture its own tops, so as to have been ready to give you and other companies an opportunity to bid on simply providing the lighting service. The estimates which we have received from time to time lead us to believe that the city, if given the necessary time, could manufacture these tops and light them during the balance of 1914 at a cost which would not make it necessary for Councils to provide additional funds. There are reasons for believing that, after paying the bills for the tops, and the materials and service required to keep them lighted, there would be a balance left in the item."

DECEMBER MEETING, NEW ENGLAND SECTION, N. C. G. A.—At the regular monthly meeting (December) of the New England Section the N. C. G. A., held in Wesleyan Hall, Boston, the evening of Friday, December 26th, Mr. Elmer S. Stack, General Manager of the Stack Water Heating Systems, gave a talk. Notwithstanding the fact it was the night-after-Christmas, and stormy as well, between 75 and 100 men holding all the varying relations in which gas men are connected to their companies were present, and from many New England towns and cities as well. Mr. Stack's talk was illustrated by the use of the stereopticon, and some 60 slides were shown during the evening. He began by explaining pictures showing practically all of the more common types of gas water heaters, including the tank, the instantaneous, the automatic instantaneous heaters and the automatic storage, the multi-storage, the distant-control, the house-heating system and the reheating system, graphically picturing in his talk points of difference and peculiar advantages which attach to each in meeting the particular conditions necessary to be covered in the service which might be required through each special system. Mr. Stack further pointed out the advantages to the gas men in the use of these different appliances, urging the necessity that a careful study should be made of the needs and requirements of conditions through which the service sought could be best met. Following these pictures the tank heater, as being the common ordinary heater generally used in the average homes, was illustrated in great detail, showing the different types of these, pointing out especially both the good and the bad points which seem inherent in the peculiar construction of each type. Taking as a standard the correct principles on which the ideal heater should be constructed, he enumerated: First, the material; second, the proper exposure of the heating surface to the fire; third, the rapid or slow circulation of the heater pointing out the different effects; fourth, expansion and contraction; fifth, deterioration of the heating qualities of the heater due to the collection of sediment and possible burning out of the heater; sixth, efficiency. The object in thus showing the various types of heaters was to endeavor to bring to the minds of his listeners the correct principles

which go to make up the heater that would give the nearest ideal service. That part of the talk was followed by a description of the installation of the heater. As the water heater must heat water by the same means or principle as in the water front, and, further, is used to heat the water in the boiler as was the water front, the water front was shown, in section, connected to a range boiler. The principles of heating water, circulation and delivery at the faucet, with cause and effect of the different manners of attaching the heater or water front to the boiler, were pointed out. In sequence the water heater was shown, connected to the boiler in combination with the water front, and a comparison made in the use of each, which seemed to show very clearly that, with the water front, the heat was usually applied for from 10 to 15 hours, whereas, with the gas water heater, requirements for hot water must be met in from 1 to 10 or 15 minutes, or in such amounts as demanded.

It was shown that, in order to deliver the hot water quickly from the gas water heater, it should be connected to the top of the boiler, this being a different manner of connecting from the water front connection. It was further pointed out that, in connecting the gas water heater in this manner, a channel had been opened up whereby cold water might pass from the bottom of the boiler up through the heater and mingle with the hot water which was being drawn off at the faucet, which was a detriment to the tank heater. Then was shown the most approved way to install the tank heater to the boiler in order to secure maximum of service at faucet, following which was shown the installation of tank heaters connected at the side of the boiler near the top. The speaker stated that the object in this connection was to prevent by-passing or the passing of cold water up through the heater. Then followed a number of very interesting slides, the first showing an incorrect installation, next the correct one, or the method of correcting the incorrect installation. These actual installations seemed to awaken in the minds of the listeners much interest, owing to the fact that Mr. Stack had invited questions from the floor as each picture was thrown on the screen. Much interest was developed at this point, because similar installations had been met by many of the gas men within their own observation, so they were glad to have this practical knowledge of correct methods presented clearly to them. In conclusion Mr. Stack showed various commercial uses to which the tank heater had been applied, some meeting conditions that had been considered by some authorities practically impossible. Mr. Stack brought out the fact very clearly that, because a customer might ask for a certain kind or type of heater, it might not be really the kind of heater which his conditions and requirements demanded. In fact, his request for a specific heater showed only that he knew of a certain appliance which under proper conditions would produce good service, and proving that what the customer wanted and needed was the best of service to meet his own conditions and the appliance to fulfill the required service. This was very graphically illustrated in an example (the installation of which was shown by the slide) whereby a customer had used a heater for two years with entire satisfaction. A neighbor had come to the conclusion it was time for him to have a heater, and, knowing the good qualities of his neighbor's service through his heater, he ordered his plumber to buy him a similar heater and install it. This the plumber did. At the end of the month the customer visited the plumber in very much worked up frame of mind, owing to the fact that he had received a gas bill more than twice the size of his neighbor's, and accused the plumber of not having installed a heater like unto that of his neighbor. Following the customer's instructions to order the same kind of a heater developed a great deal of trouble for the plumber, the gas man, the manufacturer of the heater, and the consumer, whereas if the plumber had taken the trouble to investigate the condition under which that heater was to work, in order to meet the requirements of the customer for hot water, he would have seen, as did the manufacturer, how the trouble to the gas man, the manufacturer, the plumber and the customer would have been eliminated. The entire fault rested upon the plumber, who neglected intelligently to select and install the appliance that would best meet the customer's requirements. Mr. Stack's underlying thought was that gas water heaters, being merely a means to an end, which end was the sale of gas, and it being a fact that the satisfactory purchase of gas must be through quick, convenient and economical service, the appliance which would most nearly meet the requirements for hot water in the average home, quickly, conveniently and economically, would prove the broader avenue through which the gas man would bid his sale of gas. Mr. Stack unqualifyingly contended that the duty of the gas water heater manufacturer was to so make his appliance that, through its highest possibility of service, it would render such an ideally perfect service to the customer that, naturally through its use, because of the convenient and economical service which it would render, it might best meet the interests of the gas company by opening to the widest possible extent the avenue for a natural increase in gas consumption. Mr. Stack during his speech of about 1½ hours' time, held the interest of his listeners to the end. The applause following was prolonged and hearty; and a rising vote of thanks fittingly concluded a timely and valuable lecture.—C.

CURRENT MENTION.—

On December 26th, Judge Kelly, holding Court in Albany, Ore., sustained a demurrer of the plaintiff to the defendant's answer, thus vtrtually upholding the case of the City of Albany against W. H. McGoldrick, of San Francisco, Cal., for the recovery of $1,000 on a bond that he originally gave for the erection of a gas plant in Albany. To put the case as succinctly as possible, McGoldrick, not quite 2 years ago, obtained from the authorities a franchise to construct and operate a gas plant, he to give bond in $1,000 that the works would be in operation within a year from the filing of said bond. Failing to actively redeem the pledge the bond was declared forfeited. Hence the legal proceedings; and, notwithstanding the clearness of the case, McGoldrick is proposing to carry it up to the Oregon Supreme Court.

The Messrs. H. M. Byllesby & Co. organization took over the Tacoma (Wash.) plant in 1909. Then the consumers meters set numbered 1 to each 16 of population; now the ratio is 1 to 8; the percentage gain in output is rather more than 200; the manufacturing capacity (daily) of the plant was ½ million cubic feet 1909; now, it is 1½ million cubic feet.

"One man who will remember last Christmas Eve while the 'light holds out to shine,' is Capt. W. O. Smith of the Louisville Gas and Electric Company, who, on the evening of the day noted, was presented with a Christmas remembrance in the shape of a valuable diamond ring given by 100 of his fellow workers. 'Ben.' Schulman made the presentation speech, and this was nicely supplemented by a speech from Mr. Herbert Harries, General Manager of the Company, who complimented Capt. Smith on his work and wished him the 'happiest of all happy Christmasses.'—B. R."

Beginning on January 1st., the churches of Alton, Ills., which have heretofore been supplied with gas and electric currents at 50 per cent. discount from the regular rates, will be charged full rates. This is through the operation of the new public utilities law, effective the 1st inst., which declares that public service corporations shall charge like rates to all of those with whom they have dealings.

"Burtis," writing from St. Louis, Mo., under date of the 26th of December, incloses this: "The Missouri Supreme Court has declined, through an advice handed down this week, to interfere in the gas situation in Kansas city, which to all effect was a direction to Mayor Frost (whose suit was brought to compel the Gas Company to at all times furnish sufficient gas to Kansas City) to appeal to the State Utilities Commission. This tribunal, Judge Bledsoe, with seemingly good sense of propriety, declares was constituted to consider just such such cases as this, and in summing-up over it remarks: "Having a discretion in the promises to you with an investigation, to be followed or not by an absolute writ, we exercise it by refusing to do so and by relegating the matter to the State Public Commission if those interested be advised to take that course. By excluding from this opinion certain questions, briefed by counsel, we have proceeded on the theory that to rule on them at this time would have a tendency to put the State Public Service Commission in leading strings, if its powers are ever set in motion on the subject matter of dispute. It should be left with a free rein until such time, if ever, as its commands and the evidence on which it acts come into court to be judiciously dealt with in accordauce with the Public Utilities Act."

The incorporation of Held & Co., to manufacture and deal in "scientific electric and gas fixtures," is reported from Wilmington, Del. It is capitalized in $150,000.

The Atlanta (Ga.) Suburban Gas and Light Company, a subsidiary of the Atlanta (Ga.) Gas Light Company, has agreed to lay a special high pressure main to serve the people of the city of Decatur with gas. It is agreed that the price for gas shall be $1.10 per thousand, with 10 cents off for prompt payment, or within 10 days. It is agreed further that work on the high pressure main will be commenced May 1, 1914, and will be completed as soon thereafter as possible.

Mr. Joseph Hancock, for many years prominent in the mercantile, political and social life of the Northern Liberties district, Philadelphia, Pa., died at his home, 1932 Gerard avenue, Philadelphia, the afternoon of December 24th. He served a long term on the Board of Trustees, the Northern Liberties gas works.

(Continued from page 7.)

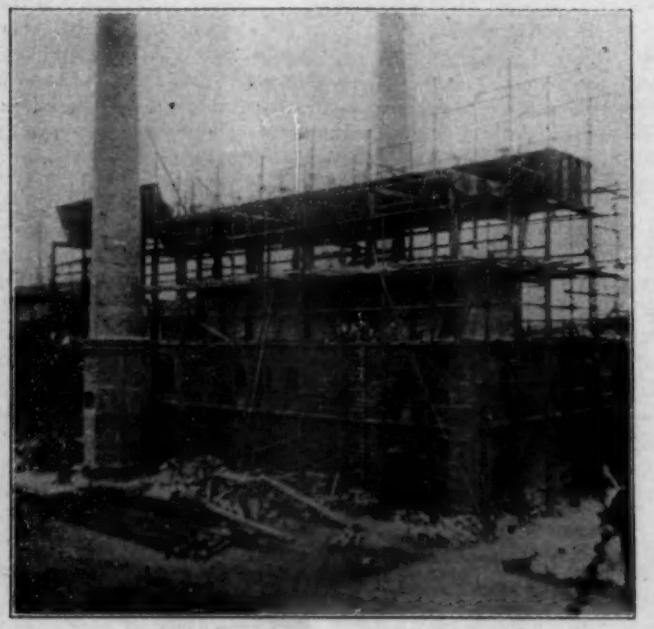


Fig. 7-W.

capacity of 7 gross tons of coal per day, arranged in batteries with outside producers, each battery having a capacity of 2 million cubic feet of gas each 24 hours. Fig. 8-W is the cross-section of two

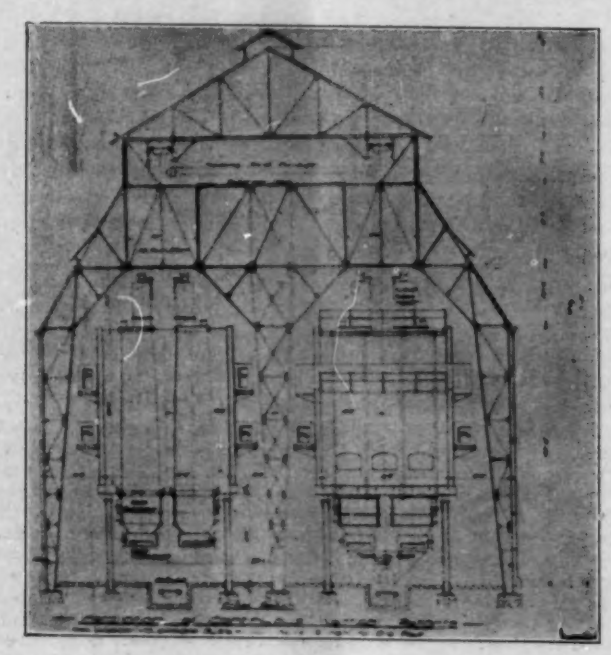


Fig. 8-W.

of these batteries proposed for Rochester, New York, with a total capacity of 4 millions cubic feet. The future of the continuous, vertical oven is very bright, and, with a capacity of 100,000,000 cubic feet daily now in operation or contracted for, the system is well beyond the experimental stage.

Coke and Gas Ovens.

A very large amount of coke oven gas is now being sold by gas companies, and the recent high price for metallurgical coke has caused a great deal of attention to be paid to this and the oven system—the distinction between the two being that, in the coke oven system, a part of the gas made from the coal is used to heat the ovens, (roughly 50 per cent.), whereas in the gas oven system all of the gas made is collected for distribution, and the ovens are heated by direct producers or by producer gas made in separate outside producers. Plants using these systems have been built largely by the Solvay Process Company, Schniewind Coke Oven Company, and the H. Koppers Company.

The plants of the Solvay Process Company (Detroit, Chicago and Milwaukee) have been in operation for some time and are more or less familiar. The Indianapolis plant of the Schniewind Coke Oven Company has been described in the Journal. It has been lately doubled in capacity by the installation of 50 more ovens. These are straight coke oven plants. The Solvay Process Company oven plant at Waukegan, Ills., was described last year by Mr. W. H. Blauvelt.

We had hoped to present a description of the new Indianapolis (Ind.) plant, of the Solvay Process Company, and the Muncie plant of the National Chamber Oven Company, but were unable to secure reports on these installations. Both plants are of the gas oven type, that of the Solvay Process Company being heated by producer gas made in outside steel producers of the Morgan type, each oven 15 tons, each with its own regenerator. This is quite different from the Waukegan plant, where the ovens are heated by direct producers, one producer to each oven, the ovens being only 8½ tons capacity.

The Muncie plant of the National Chamber Oven Company is similar is type to that at Waukegan, the heating being by direct producers, but differs in that the ovens are divided into chambers of 5 tons capacity, and there is one double furnace for each oven of 3 or 4 chambers.

The Koppers system of coke and gas oven construction is well presented in the following report of Mr. T. V. Salt, which also embodies a description of the Koppers system of direct ammonia recovery.

Description of a Battery of Koppers' Cross Regenerative By-Product Coke Ovens.—A battery of Koppers' ovens consists of a series of hollow walls, of the finest silica material, which are really silica beams resting on rigid foundations.

The space between the walls is divided horizontally into 2 compartments, the upper forming the coking chamber, the lower the regenerators. Fig. 3-K shows the relative position of the regenerators to the oven chamber and the direct connection of the regenerators to the heating flues.

In the hollow walls forming the coking chamber are a series of vertical flues opening into one common horizontal flue, extending the entire length of the wall. (See "G" Fig. 1. K.) It is in these flues that combustion takes place and the heat is transmitted through their walls into the coal mass. The coking chamber is sealed at the ends by heavy iron doors of the self-sealing type, or of the plug type, resting against the wall-jambs. Each door on the pusher side has a small self-sealing door large enough to permit a traveling bar to enter for the purpose of leveling the surface of the charge, so that the gases evolved during the coking process may have a free path to the off take at the end of the oven.

The coal is charged from larry cars, through holes in the roof, usually 4 in number, with self-sealing covers.

Figs. 1-K and 2-K are longitudinal sections of the oven chamber regenerators and heating flues and show the position of the charging holes and the gas off-takes.

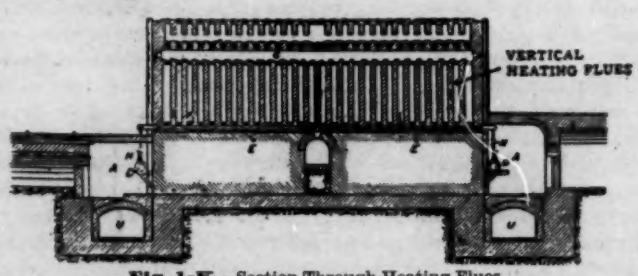


Fig. 1-K.—Section Through Heating Flues.

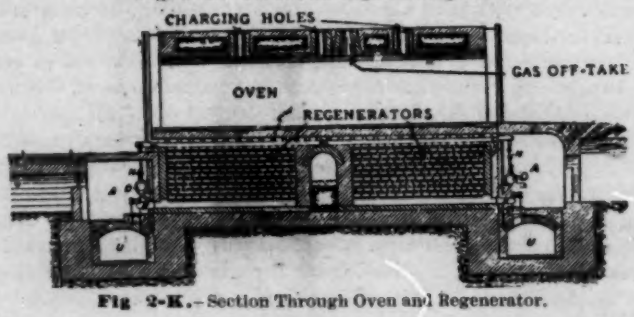


Fig 2-K.—Section Through Oven and Regenerator.

Course of Combustion.—A line drawn vertically through the center of (Fig. 1-K) will enable the course of combustion to be followed. The gases burned in the flues on one side of this line proceed upwards; the products of combustion travel across the horizontal flue, *G*, and downward through the flues on the other side, through the generators and to the stack. The process is reversed at periodic intervals usually of 30 minutes.

The Character of Gas Required for Heating.—The heat required to coke a unit of coal is generally less than 50 per cent. of the total thermal value of the gas evolved by its distillation, and gas used for this purpose is generally freed from the by-products. It may be that this gas is wanted for sale, in which case cheaper fuel, such as the gas from producers operating on a lower grade of coal, or blast furnace gas, is used.

Distribution.—The fuel gas is delivered to the battery in the mains, *D*, through the pipe, *H*, into the gas channel, *E*, which is an air-tight duct immediately under the vertical flues, extending the entire length of the ovens, being dead-ended in the center, At the base of each flue is the gas nozzle, *F*, through which the gas flows from the duct into

the flue for combustion. The air for combustion enters at the base of the regenerator, ascends through the checkerwork and is heated to about 1,800° F. The heated air then passes through the ports, *C*, at the base of each flue, and mixes with the gas at a point about level with the floor of the oven.

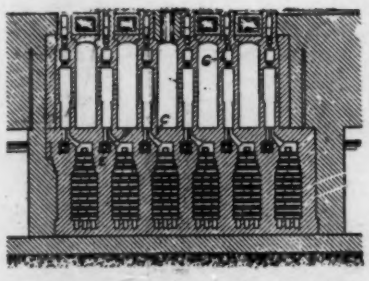


Fig. 3-W.—Cross-Section Through Ovens, Flues and Regenerators.

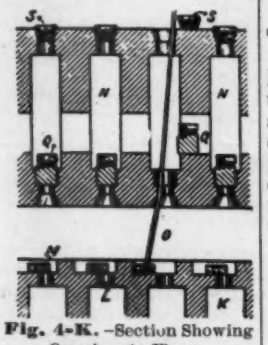


Fig. 4-K.—Section Showing Openings in Flues.

It will be seen each wall is a separate heating unit, having its own gas and air supply. It also has its own regenerator, directly connected to the stack and equipped with a regulating device for the stack draft. In order to have the same heating conditions for each oven all that is necessary is to maintain a uniform supply of gas in the mains, *D*, and the same amount of stack pull at the base of each regenerator outlet.

The individual cross regenerator permits a much greater capacity than the longitudinal, the Koppers' individual regenerator having a capacity 4 times greater than that in general use in other types. The protected location of this type of regenerator makes the sub-structure simple in character, much less liable to expansion defects and permits less radiation. The individual regenerator is an essential feature of the Koppers' system.

Regulation of Combustion.—This feature of the Koppers' ovens we desire to lay stress on. When an oven is charged, we have a rectangular mass of coal about 35 feet long, 9 feet high and 19 inches in width, exposed to the surface of a highly heated wall on both sides, these walls made up of 30 flues in which combustion is carried on continuously.

The object is primarily to transmit the required amount of heat into the coal so that the entire mass will coke uniformly and in the shortest space of time. Elminating all refinements, the chief factors are:

The rate at which coal will absorb heat, the rate and intensity at which combustion can be maintained, and the quantity of heat that can be transmitted through the oven wall to the coal. The problem of this means the shortest coking time and the maximum tonnage.

Before the above equation can be balanced, we must assure a *uniform transmission* of heat over the entire surface of the coal exposed to the heating action of the walls, and to do it we must maintain a uniform intensity of combustion throughout the length and height of the heating flues that form the walls. To maintain such ideal conditions we must have control over every foot of heat-surface, and in order to have this control there must be accessibility to every part of the heating system; not only up to the oven, but including the oven itself.

The Koppers' oven generally depends on natural draft, and the flue dampers and air valves control the air supply. It is obvious that up to this point everything is accessible and under positive control.

Fig. 4-K shows an opening through the roof into each flue, the opening being a continuation of the flue proper, but closed by a cover brick.

Raising the cast iron covers exposes the entire exterior of the flue for inspection, and thus observation of the combustion taking place throughout the length of the oven is made easy. The gas opening to each flue is a nozzle having a definite size opening. Alongside this nozzle is the air port, calculated for an air supply, and bearing an exact relation to the area of the vertical flues. It is then only a question of regulating the amount of air drawn into each flue, and fitting the opening at the base of the flue with the proper size gas nozzle in order to obtain exactly the intensity of combustion desired. At the bottom of the horizontal chamber, *O*, is an opening covered by a sliding brick, *M*, which is an adjustable damper controlling the amount of draft for each flue. Some idea of the refinements had will be possible when we say that the tools to gauge the adjustment are graduated in millimeters (25 millimeters = 1 inch).

Farther up is another opening, completely closed by a coverbrick, *C*, except during inspection and regulation. By taking off the lid, *S*, sliding back the intermediate coverbrick, *C*, an unrestricted view is obtained of the interior of the vertical flue. It is a simple matter to adjust the sliding brick damper, *M*, to obtain any intensity of combustion for each individual flue. If local overheating occurs in any part of the oven wall, simply open those particular flues, taking the nozzle out and putting in a small one or vice versa, by means of a rod. Once a regulation has been made for an entire oven it is not necessary to interfere with it until general conditions change. Once the regulation for any definite coking time is established, it is simply a question of raising or lowering the gas pressure, increasing or diminishing the stack draft. If from an oven charge the coke is not uniform throughout, to be able to inspect or correct conditions for that particular oven is a big advantage. The ability to positively control the rate of coking means that the maximum efficiency can be maintained, which efficiency can be expressed in dollars and cents.

Koppers' Regenerative Gas Oven Chamber.—The gas chamber oven is merely a modification of the regenerative coke oven.

The object of a coke plant is to make coke with the recovery of as high a yield of by-products as consistent with proper operation. In the gas oven the object is to produce as high a yield of gas as possible and of the proper quality, and it is not desirable to use any of the gas distilled from the coal for fuel. It is, therefore, desirable to install a producer plant, using a low grade fuel, the producer gas being cleaned and regenerated and burned to heat the ovens. If the ammonia is taken from the producer gas a very low cost fuel can be obtained.

Fig. B. shows the changes in construction. The regenerator chambers are subdivided by the partition wall, *C*, with openings into the combustion flues as in the coke oven. Air and gas are regenerated in alternate sets of regenerators. For illustration, air would enter at the base of the regenerators marked *AA*, the gas would enter the regenerator chamber marked *BB*. The advantages of dividing each regenerator and passing the same material through, whether it be air or gas, are in the fact that, should the division walls, *C*, develop leaks, no harm can be done, as the material is the same on both sides. There is no fuel gas duct under the flues as in the coke oven, the producer gas being regenerated enters the vertical flue through the ports.

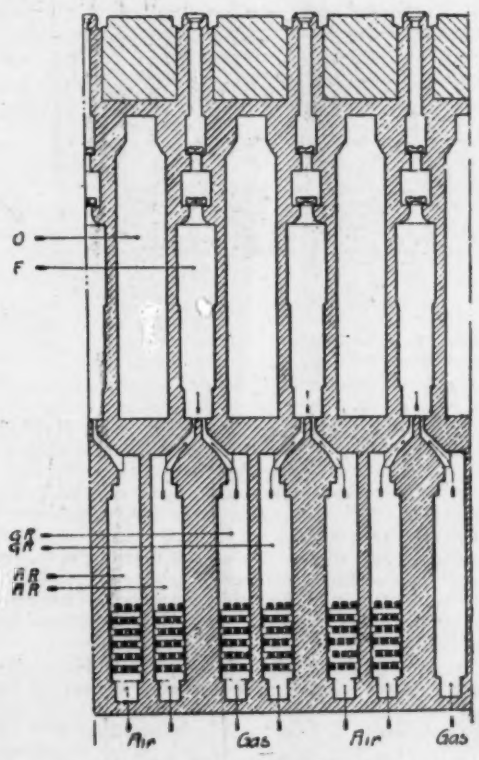


Fig B.—Cross Section of Gas Oven.

Koppers' Regenerative Combination Coke and Gas Ovens.—Fig C. is designed to act as a coke oven until such time as the demand for gas makes it advisable to operate as a gas oven. The only difference between it and the gas oven is the addition of the gas distributing flue. It can also be operated as a coke oven, the regenerators being used exclusively for air, as coal gas should never be regenerated. When the demand for gas increases, a producer plant is installed and the ovens operated as gas ovens using the producer gas for fuel. It may be advisable, for instance, to operate as a gas oven in the winter and as a coke oven in the summer.

This oven is well adapted to localities where the present gas demand is equal to the surplus gas output of the battery and where indications are dhat the demand will be doubled.

Koppers' Direct Process for Recovery of Ammonium Sulphate.—This process is based on Dalton's law of vapor tension of liquids when mixed with gas, by which it is possible to prevent the vapor condensing at any temperature. In adjusting the temperature of the gas by a reheater which raises it the required degrees, the gas can be passed directly into the acid bath at a comparatively low temperature without condensation taking place. The hot gas from the ovens enters the water tube condensers or coolers, where it is cooled to about 90° F. In the cooler most of the tar and water vapor condenses and the gas is then forced through the tar extractors where the last trace of tar is removed. From there the gas goes to the reheater where, by exhaust steam, its temperature is increased 20° or 30° F., so that it is no longer saturated for the higher temperature. The gas then passes into the saturator, which contains a saturated ammonium sulphate solution, with about 5 per cent. free commercial sulphuric

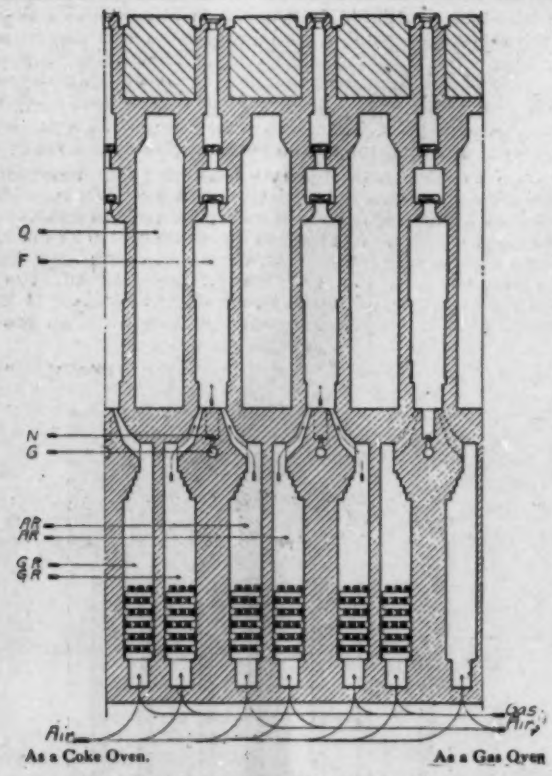


Fig. C.—Cross-Section of Combination Oven.

acid. The gas is forced through the bath in finely divided streams, and the intimate contact of the ammonia with the acid forms ammonium sulphate, which is instantly precipitated, due to the saturation of the bath. The saturator is totally enclosed, and the sulphate crystals are ejected into a draining box by air or steam. From the draining box the sulphate is dumped into the centrifugal dryer. The process is continuous and the acidity of the bath is constantly main tained, assuring a constant uniform quality of product. The gas passes from the saturator into the acid separator, where any acid carried over is removed. The gas then passes to the fuel gasholder or to the mains for surplus gas.

The water vapors condensed out of the gas in the coolers contain ammonia, and this weak liquor, together with the tar, is drained to a tank and separated. The weak liquor is pumped into the ammonia liquor storage tank, and the ammonia is distilled and led as a vapor to the header in front of the saturators, where it is introduced into the gas stream. In this way the recovery of ammonia is complete. The bath containing 5 per cent of free acid has no effect on the quality of the gas.

The process is well adapted for installation in existing by-product recovery plants using the old wash or indirect progress, or in gas plants where it is desired to manufacture ammonium sulphate. The space occupied is much less than that required for ammonia washers and other apparatus. Among the advantages derived are the following:

Reduction of mother liquor.
Less water used.
Reduced wear-and tear on saturators on account of low heat.
Lower first cost.
Increased yield of ammonia because of less loss by volatilization.

The Vienna Gas Plant.—This municipal plant supplies illuminating gas to Vienna, Austria, and consists of 118 Koppers' cross regenerative gas chamber ovens, divided between two plants. The Simmering works have 46 ovens, with a capacity of 5,250,000 cubic feet per day, and the Leopolda works 72 ovens, with a capacity of 7,400,000 cubic feet.

The Birmingham Plant.—There has recently been put into operation at Birmingham, England, a battery of 12 Koppers' cross regenerative, gas chamber ovens. This first installation was so successful that an order has been placed for 54 more ovens, which are to be heated with producer gas generated on the Mond principle, thus ammonia in the producer gas will be recovered in the form of sulphate, and it is expected that the cost for fuel will be materially reduced.

The By-Product Coke Oven Plant of the Coal Product Manufacturing Co., Joliet, Illinois.—This plant was described last year by Mr. H. L. Rice, and needs no further comment, except to state that it is in successful operation. It is evident from the above reports that much of the progress of the various systems of carbonization is due to the use of silica material, and that, in horizontal retorts and coke oven plants, it has been almost universally adopted, and by at least one of the builders of the continuous vertical systems; and we have made an effort to secure additional information regarding this material.

The following letter was received from England, relative to the new form of silica material, and samples have been sent for:

MR. R. M. SEARLE: Dear Sir—The statements made by Herr Körting and yourself, anent silica material, in the discussion on the report of the Refractory Materials Committee of the Gas Engineers' Institute, were highly interesting to me as patentee of a new process for manufacturing such material, for which patent was granted by U. S. A., No. 976,996. We claim for this process that, from a suitable form of SiO_2, a superior product can be made, which—

(a) Has greater fire stability.
(b) Has practically *no further expansion.*
(c) Is not liable to crack or flake off under sudden changes of temperatures.
(d) Its porosity and conductivity can be varied in manufacture as required.
(e) It is applicable to the various forms of silica and is very successful with sand.

(a) The National Physical Laboratory here tested brick made from Durham ganister by our process and certified that it was not affected at 1,800° C., and that it was not until a point between 1,850–1,900° C. was reached that thin sections, supported at their edge and weighed in center with a carbon rod, showed signs of bending.

Dr. Mellor recently had sent to him, unknown to me at the time, a local sand and piece of brick made therefrom by our process, with instructions to

(a) Analyze the sand and test its fusion point.

(b) Test the fire stability of the brick, and its expansion by the specification test of the Institute.

He reported that the sand contained 2 per cent. alkaline oxides (potash and soda) and 34 per cent. CaO and MgO. That its fusion point is 1,740° C.; (b), that the brick had fire stability between 1,720° and 1,730° C.. That its expansion was 0.16 per cent.

Our tests for expansion of vertical retorts of other silica made by our process gave from 0.075 up to 0.1 per cent. They write: "The material is thoroughly satisfactory * * * and that they attribute a very high character to it."

(c) Immunity from cracking and flaking off: Cold brick may be placed on red hot fire without appreciably damaging it. I have made brick hot (bright orange) and plunged one-half into cold water.

(d) Bricks made from a good sand by our process were but slightly affected by conditions in a Siemen's crucible steel furnace, which reduced the best Sheffield ganister brick to a mass of vesicular slag. These characteristics are such as should appeal to you. The cost of manufacture from sand is considerably less than from the crystalline rock, and silica in such shape is widely distributed and easily obtained. The process is applicable to all forms of refractory oxides, bauxite, corundum, chromite and magnesite, yielding products superior to those made by other methods.

We also believe that the following specifications used by the H. Koppers' Coke Oven Company will prove of interest:

Size, Shape and Uniformity.—1. All standard, 9-inch, straight silica brick must be rectangular in shape, and not vary more than $\frac{1}{16}$ inch above or below their standard dimensions. They shall have no spongy corners and shall be uniformly solid throughout.

2. All silica-shape brick shall be made to size as given on drawings, and shall not vary from normal dimensions more than the allowable variations indicated thereon. They shall not be bent or warped, and the corners shall be well filled and the brick uniformly solid throughout.

Materials and Manufacture.—3. All brick shall be made of evenly ground and mixed material of a grind not larger that $\frac{1}{4}$ inch cube.

4. All silica straights and shapes shall be made with the clay as wet as the bricks will permit. All dry clay moulding shall be avoided. No repressing of silica shapes and straights will be allowed.

Impurities.—5. Silica brick shall not contain more than 2 per cent. of lime.

6. Oxide of iron shall be kept to a minimum and any surfaces or cross sections of the brick, marked with spots of oxide, shall be such that the combined areas of the spots do not exceed 2 per cent. of the surface. The iron content shall be so low that coke oven gas shall have no detrimental effect upon the brick.

Burning.—7. All silica brick shall be burned to reach the limit of their expansion, or to a heat affecting a No. 26 seger cone (3,000° F.) and laying a No. 20 seger cone (2,780° F.).

8. The brick shall be allowed to remain at the above specified temperatures long enough to allow the heat to penetrate the entire mass.

9. The kiln shall be cooled off slowly, to avoid shrinkage cracks. No cracked or broken brick will be accepted.

10. All brick shall give a sharp, clear, ring on being struck with a hammer, and shall be free from soft spots or centers, dark yellow or red in color.

Expansion.—11. The expansion in finished brick shall not exceed 3/16-inch per linear foot, at 2,700° F.

12. After repeated heating and cooling silica brick shall not show any permanent expansion.

Refractoriness.—13. Silica brick must not soften at a temperature of 3,000° F., under a load of 25 pounds per square inch.

Porosity.—14. Brick shall have a porosity of not less than 12 per cent. by volume and 6 per cent. by weight. To test the porosity the brick shall be dried and weighed, and boiled in water for 3 hours, then left in the water to be cooled. The brick is taken out of the water,

the surface dried with a cloth, and weighed. The volume of the water, absorbed, as determined by weight, is compared with the volume of the brick.

Finished to Size.—15. All necessary chipping and grinding of shape brick shall be done by the manufacturer. The cost of any such chipping of oversized or bulged brick done by H. Koppers' Company shall be paid for by the manufacturer.

Inspection.—16. All material delivered under these specifications shall be subject to the inspection of the chief engineer of H. Koppers' Company, or his properly accredited representatives.

17. The manufacturer shall permit the engineer or his representative to inspect the materials at any stage of manufacture, and shall furnish all required information regarding the methods of manufacture and the chemical combination of the materials. The engineer or his representative shall have the right to inspect all moulds used in connection with the manufacture of the materials.

STANDARD SPECIFICATIONS FOR FIRECLAY BRICK.—H. KOPPERS' CO.

Size, Shape and Uniformity.—1. All standard, 9-inch, straight brick must be regular in shape, and not vary more than 1/16-inch below or above the standard dimensions. They shall have no spongy corners and shall be uniformly solid throughout.

2. All clay, shape brick shall be made to size as given on drawings, and shall not vary from normal dimensions more than the allowable variations indicated thereon. Shape brick shall not be bent or warped, and the corners shall be well filled and the brick uniformly solid throughout.

Materials.—3. All brick shall be made of evenly ground and mixed material, of a grind not larger than ¼-inch cube.

Impurities.—4. Oxide of iron shall be kept to a minimum, and any surfaces marked with spots of oxide shall be such that the combined areas of the spots do not exceed 3 per cent. of the surface. The iron content shall be so low that coke oven gas shall have no detrimental effect upon the brick.

Burning.—5. All first quality brick shall be burned in a heat not less than 2,600° F., laying a No. 14 seger cone (2,570° F.), and turning a No. 16 seger cone (2,642° F.)

6. All second quality brick shall be burned in a heat not less than 2,350° F., laying a No. 7 seger cone (2,318° F.) and turning a No. 9 seger cone (2,390° F.)

7. Brick shall be allowed to remain at the above specified maximum temperatures long enough to allow the heat to penetrate the entire mass.

8. The kiln shall be cooled slowly to avoid shrinkage cracks. No cracked or broken brick will be accepted.

9. All brick shall give a sharp, clear ring on being struck with a hammer, and shall be free from soft, unburned spots or centers.

Expansion.—10. The expansion in finished brick shall not exceed ¼ inch per linear foot, at 2,500° F.

11. It is understood that clay brick will show a further contraction when heated higher than the temperature at which burned. Therefore, first quality brick, after heating to 2,500° F., shall *not* show, when cold, a contraction of more than $\frac{1}{16}$ inch per linear foot, as compared with the size before reheating.

Second quality brick, after heating to 2,300° F., shall *not* show, when cold. a contraction of more than $\frac{1}{16}$ inch per linear foot, as compared with the size before reheating.

Porosity.—12. Brick shall have a porosity of not less than 12 per cent. volume and 6 per cent. by weight.

13. Second quality clay brick will not be required to have a porosity as specified above. They may be less porous and may be hard burned, almost to vitrification.

Finished in Size.—14. All necessary chipping and grinding of shape brick shall be done by the manufacturer. Any chipping of over-sized or bulged brick done by H. Koppers' Company shall be paid for by the manufacturer.

Inspection.—15. All material delivered under these specifications shall be subject to inspection of the chief engineer or his accredited representative. The manufacturer shall permit the engineer or his representative to inspect the materials at any stage of manufacture, and shall furnish all required information regarding the methods of manufacture and the chemical combination of the materials. The engineer shall have the right to inspect all moulds used in connection with the manufacture.

A development which has been mentioned, and one which is worthy of careful consideration, is the use of separate, outside producers to supply the gas to heat the carbonizing chambers. These may be of the recovery or non recovery type. The Koppers' ovens at Birmingham, England, are heated with Mond gas from a non recovery producer, but careful tests show that, with the completion of the additional battery now building, a very material saving will be affected by recovering the ammonia, as from 12 to 18 pounds of ammonia are recoverable per ton of coal gasified. If producers are of the non-recovery type, the sensible heat of the producer gas may be recovered as steam or hot water by waste heat boilers or economizers, or the use of a producer of the Kerpely type, which is in itself a boiler. A large plant of Koppers' ovens, heated with gas made in Kerpely producers using coke breeze, has been in successful operation for some time at Vienna.

With the use of silica material and larger carbonizing chambers, it becomes more important that we should have a regulated, and unvarying supply of uniform heating gas, and the separate producer under pressure seems to meet this need; and if the sensible heat. amounting to 10 or 12 per cent., can be saved, either by the recovery of ammonia or as steam, this method of heating offers much of promise.

Some other developments closely related to carbonization progress are of sufficient importance to require special mention. The direct recovery of ammonia by the Koppers' process has already been described. The Feld process should receive careful consideration. A plant using this process is in successful operation at Koenigsberg, and a contract has been made for a large addition. The process has been tested in this country and seems finally to have reached the crucial point. In it the ammonia, and from 50 to 70 per cent. of the sulphur in the gas, are removed simultaneously by wet scrubbing, in the form of polythionates of ammonia. These polythionates upon heating deposit sulphur and form ammonium sulphate. The sulphur recovered is burned to form sulphur dioxide, which is used to treat the wash liquor. The process is not complicated and requires but little labor.

A method of removing hydrogen sulphide, by means of scrubbing with treated ammoniacal liquor, is described in another paper at this meeting. The reactions involved have in a general way been known since the time of Claus, but only recently has the process been worked out on a commercial basis, in this country by Mr. J. G. O'Neill, of Geneva, N. Y., and in England by Dr. W. B. Davidson, of Birmingham. The important point overlooked before is the role played by temperature and pressure in giving an ammoniacal liquor of suitable strength and purity. The beauty of this process is its simplicity and the ease with which it may be put in operation in almost any coal gas plant.

The washer cooler system of condensation promises much saving of ground area and repairs. High speed, rotary, gas pumps of the centrifugal type as exhausters, do away with pressure pulsations and also are very effective as tar extractors. Shaking grates in furnaces to relieve clinker troubles and secure uniform fire conditions, and boilers or economizers in the waste gas passages to recover heat otherwise lost, seem to be wise investments. These things are not "fads," but developments which have come slowly and are here to stay. It seems that in the latest designs of the horizontal plants the limit of development had very nearly been reached; that vertical systems had something to look forward to in the case of silica material and a more uniform supply of producer gas from outside producers; and that the coke and gas oven plants could dispense with much machinery by standing their ovens on end. It is interesting to note that the coke oven builders are looking forward to a vertical coke oven; the intermittent vertical retort system builders are about to make their retorts much larger; and that the Woodall-Duckham systems of continuous operation have changed from moulded retorts to built-up chambers, first of 5 ton capacity, now of 7 tons. Are the three sign posts pointing to one mainroad—a continuously operated vertical gas oven heated by gas from outside producers?

H. RUSSELL, Chairman, W. E. STEINWEDELL, D. R. RUSSELL,
H. A. CARPENTER, J. S. DE HART, J. H. TAUSSIG,
G. A. BALZ, T. V. SALT, E. Y. SAYER,
Committee.

New Methods and Appliances.

SAWDUST FIRE EXTINGUISHING.—Experiments in a varnish manufactory show that sawdust is of considerable value in extinguishing the fires frequently arising in the varnish industry. At first sight it would appear that a material combustible like sawdust was not suitable for fire extinguishing purposes, but the experiments are convincing as to its efficacy. Seventeen experiments were made, some of the results being given below:

No. 1.—In a steel vessel containing ignited varnish 2 inches deep, the fire was extinguished in 25 seconds with 2½ shovelfuls of sawdust.

No. 4.—In a vessel containing varnish 4 inches deep the fire was put out in 10 seconds with a quarter of a shovelful of sawdust mixed with sodium bicarbonate.

No. 9.—On a pine tray, 5 feet square, with sides 1 foot 8 inches high, containing nearly 3 gallons of varnish, the fire was extinguished in 53 seconds with 3 shovelfuls of soft-wood sawdust.

No. 13.—In a steel vessel containing 3¾ inches of gasoline, the fire was quenched in 13 seconds with 2 shovelfuls of hardwood sawdust.

No. 6.—In a steel vessel containing varnish, 3 inches deep, the fire required 9 shovelfuls of sand for extinction.

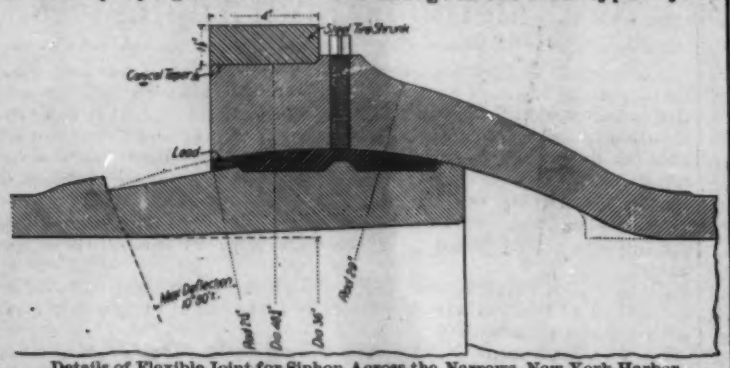
No. 16.—In a steel vessel containing gasoline 2¾ inches deep the fire was not affected by 4 shovelfuls of sand, and was afterwards put out in 56 seconds by 8 shovelfuls of sawdust.

The efficacy of sawdust is attributable to the fact that it floats on the ignited liquid and protects it from the air, whereas sand sinks to the bottom.

WATER-TIGHT CONCRETE.—Experiments on the permeability of untreated concrete are being carried on in great detail at the College of Engineering, University of Wisconsin. The tests already made show that good results are obtained if the concrete remains in the mixer from 2 to 3 minutes when dry materials are employed, but that if the sand and gravel or stone are damp a considerably longer time is re-

quired. Therefore, the use of wet sands should be avoided. The experiments showed that mixtures of 1 cement, 1½ Janesville sand, torpedo grade, and 3 Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 pounds per square inch. Mixtures as lean as 1 part cement to 6 gravel (a graded mixture) have been made impervious at high pressures by using care in proportioning the amount of water and in mixing the batch. The specimens used in these tests are cylindrical in form and so made that the faces of the cylinders, 13½ inches in diameter, are exposed to the predetermined water pressure. The thickness of the concrete through which the water must pass can be varied from 4 to 18 inches. They are also studying the effect of varying the percentages of cement and water, the gradation of the sand and gravel, the proportioning of the mixture and the thoroughness of mixing, on the hardening of the specimens.

Flexible Submarine Joints.—Alfred D. Flinn, writing in "Engineering Record," says that in order to carry a supply of water from the Catskill aqueduct to the most outlying of the 5 boroughs of New York City, a difficult and interesting inverted siphon is about to be put under contract. Staton Island, constituting the Borough of Richmond, lies close to the New Jersey mainland, but legal barriers prevent its water supply being obtained from that State, so Catskill water must be conveyed from Brooklyn across the Narrows of New York Harbor. This crossing is too long, the underlying rock at too great a depth, and the quantity of water to be delivered is too small to permit a pressure tunnel being built. After considering many schemes, a cast iron, flexible-jointed, submarine pipe line was selected as most feasible and economical, a diameter of 36 inches being decided upon as the practical limit of size. The line mill be nearly 10,000 feet long and require approximately 3,800 tons of pipe. The Narrows is the main entrance to New York harbor from the ocean, and one of the busiest places of its kind in the world. Besides the two channels the pipe line will cross an anchorage ground for merchantmen and one for men-of-war. The government requires a minimum water depth of 45 feet below mean low tide, so across this anchorage ground, where the depth of water is now 30 feet, dredging to a depth of about 30 feet below the harbor bottom for a length of nearly 3,000 feet will be required. Across the channels a trench will be dredged deep enough to permit covering the pipe at least 8 feet. This dredging must be done athwart the currents, rendering the trench liable to some refilling by bottom material being carried into it between the time of excavation and the laying of the pipe. The maximum, natural depth of the water is about 60 feet, but to the bottom of the trench will be nearly 72 feet. A number of soundings and wash borings were made in an attempt to get information about the profile and character of the bottom, but the results are less certain than could be desired. Apparently the bottom material is mostly sand, of various degrees of fineness, with some gravel in places, overlaid with silt and sewage sludge, varying in depth. Prolonged study was given to the design of the pipe and the metal of which it should be made. Dense, strong, cast iron, as low in graphitic carbon as could be obtained, was considered the best material and the customary 12-foot lengths are to be used, unless the pipe foundries find it practicable to increase the length. A few 6 foot lengths may be used where change in profile is abrupt. Each length will have a flexible joint, the Ward-Duane joint being selected and endeavors were made to improve it. The adopted design is shown in an accompanying illustration. The change in the older type of joint



Details of Flexible Joint for Siphon Across the Narrows, New York Harbor.

is the addition of the gib-screws, to be used as pumps for forcing cold lead into the shrinkage space of the joint. After the tentative adoption of the Ward-Duane much attention was devoted to the kind of metal to be used in the "lead space," commonly so-called. The material shrinkage of soft pig lead, when cast into such a space, in accordance with usual practice, was well known, and the relatively shallow effect of even good calking on a joint made by pouring lead was also known; both these phenomena were further observed experimentally.

Calking, even with a pneumatic hammer in the hands of a skilled workman, consolidated the lead not more than ⅜ to ½-inch from the face of the joint. When a calked joint is moved, as in the deflection of a flexible joint, the effect of the calking is almost completely nullified. Lead wool was tried, because it could be calked strand-by-strand from bottom to face of the lead space, and, being put in cold, would not shrink like the poured lead. This material made joints which remained tight under hydrostatic pressures so high that cast lead joints in the same pipe line were driven nearly out of the bell. But the lead-wool joints were so rigid that the pipes could not be deflected without so great a force that the purpose of the flexible joint was defeated.

That lead would flow readily under comparatively low pressures—700 pounds per square inch—when steadily applied was demonstrated experimentally. Advantage was taken of this property of the lead when the addition of the screws to the Duane joint was suggested. The tap bolts having been put in so that their ends were flush with the inner surface of the bell of the pipe, molten lead was poured in to fill the joint space in the usual way. After the lead had cooled, the screws were removed and a stiff mixture of graphite and thick mineral grease was forced into the shrinkage space between the lead and bell. Cast lead plugs, about ¼-inch in diameter and 1-inch long, were then put (one at a time) into each hole and forced into the joint space by screwing the bolt home, a man doing this readily with a 12 inch wrench. In this way about 100 plugs were forced in through the 16 holes.

Evidence that the shrinkage space had been pumped full of lead was given by the slight movement at the face of the joint and the oozing of the mineral grease. Such joints remained watertight before, during, and after deflection in both directions and deflected easily. The surface of the lead exposed by the deflecting showed that the joint space was thoroughly filled. More rapid means than the man with the hand-wrench will doubtless be devised for lead pumping in practical pipe laying. Some further modifications of this joint have been suggested, but not tested, and the contractor, when selected, may contribute some ideas from his experience.

Provision is made in the contract for testing the pipe line in successive sections during the progress of laying, so that if a few joints are defective after being submerged they can be calked by divers. Provision is made also for a preliminary test after a short stretch of line is laid to determine the practicability of the method outlined. If this preliminary test should indicate that an acceptable degree of tightness cannot be attained in this relatively simple way, resort will be had to another provision of the contract, for general submarine calking, with a guarantee by the contractor that the leakage will not exceed the rate of 40 gallons per joint per 24 hours. To aid in the discovery of leaky joints under water, provision is made in the contract for the use of air under pressures up to 80 pounds per square inch, if necessary.

Items of Interest
FROM VARIOUS LOCALITIES.

The Directors of the Consumers Gas Compaay, Toronto, Ont., recently voted to accept bids for its unissued shares, to the number of 3,140, at a premium of 62 per cent., which will realize a total of $254,262.

The residents of Lestershire, a suburb of Binghamton, N. Y., are very anxious to have the gas mains of the Binghamton Company put through their streets. In fact, some of them are even discussing the good policy of putting a separate plant in Lestershire. The latter, however, would not in any sense be tenable, for the works of the Binghamton Company are not over 3 miles away from the Lestershire line. Meanwhile, it does seem odd that the Binghamton owners have not by this time voluntarily gone into the Lestershire line, which place certainly has a population not less than 4,000. Besides, it sustains a number of factories making a variety of small goods, such as bobbins, paper boxes, spools, furniture, etc.

For the year ended July 1, 1913, the gross earnings of the Peoples Lighting, Heating and Power Company, of St. Albans, Vt., amounted to $25,043.38, and a check for $500.86 (or 2 per cent. on that gross amount) was turned into the city treasury at the close of the year. This tax is in accordance with the stipulation under which the original St. Albans Gas Light Company was first granted its license to transact business some years ago.

It is declared on very good authority that oil seepages from the Calgary Alberta field have, on properly conducted tests, shown the highest gravity of any oil field ever known. Tests give returns of from 60 to 65 per cent. fineness—ordinary gasoline is rated at about 25 per cent. Alberta, in fact, is the only known place where oil from seepage can be used in gasoline engines without refining, and it is declared that the product has at least 3 times as great driving power as the ordinary commercial gasoline. Anent these rerearches Cunningham Craig, whose ability in the line of oils, including their production, refining and uses, is world known, and who is consulting engineer for the British Government's interest in the great oil syndicate of Burmah, is advising a syndicate that, having secured oil leases covering thousands of acres of lands and locations, is making arrangements for a thorough exploration of the fields by means of actual drilling operations.

THIS was forwarded us by a correspondent in Los Angeles, Cal., writing under date of December 26th: "Last week Judge B. F. Bledsoe signed the judgment, in favor of the city of San Bernardino, in the matter of the injunction proceedings instituted by the Southern California Gas Company, to prevent the gas rate ordinance from going into active effect. So ends the litigation that has been in progress for some months. I should have added that the Court also orders that the impounded moneys (now amounting to about $5,000), representing the difference batween the old gas rate and the new one, be forthwith returned.—B. M. S."

THE Board of Gas and Electrical Commissioners, of Norwich, Conn., at a meeting held some days ago, appointed Mr. Fred. S. Maples, to succeed Mr. Archa W. Colt, as Clerk and Cashier of the Board. The new appointee was for years prominent in the bookkeeping department of the Hopkins-Allen Firearms Company, is a member of the Norwich Arcanum Club, and is generally liked by the residents of Norwich.

WORK has been commenced on the huge coke oven system that has been arranged for the Laclede Gas Light Company, of St. Louis, by its engineering staff. The plant, which is located on a plot of 200 acres, is bounded by South Broadway and the Mississippi river, Klausmann's Grove and Jefferson Barracks. The first plant units will consist of 56 ovens, up to coking 750 tons each 24 hours.

THE Muscatine, Ia., gas rate ordinance, under which the flat rate of $1 per 1,000 cubic feet is sought to be established there, will be contested. It is noteworthy that the ordinance on final passage was sanctioned by the casting vote of Mayor Koehler.

"V. T. R.," writing from Portland, Me., under date of the 26th December, reports: "Work is already underway on the generating plant, at Holland Rrook, of the Kennebec Gas and Fuel Company, which is to supply the residents of Waterville, Fairfield, Winslow, Oakland, Vassalboro, Skowhegan, and other intermediate Maine points. And here I might inform you that it is claimed this territory, square-mile for square-mile, contains a population, greater in numbers, than may be counted elsewhere in the States, unsupplied with gas. The plant is about midway of Fairfield and Waterville, and is seated back of the main road, almost bordering the west bank of the river. A siding from the tracks of the Maine Central Railroad enables the best possible means of receiving materials and supplies of all sorts; for the hauling of goods is a big item in the domestic economy of 'these parts.' The generating apparatus is of the latest water gas type, and the buildings will be of the fireproof sort, in so far as possible. If possible I will send you a plan of the main system arranged for, the planning of which you may rest assured was not completed in many days."

"B. M. L.," writing from Terre Haute, Ind., under date of the 27th ult., says: "Last week a suit for damages, occasioned by an accident, that surely points a moral for meter statement takers, was brought against the Citizens Gas and Fuel Company of this city. The complainant is Mrs. Elizabeth Lawrence, who asks for damages in the sum of $10,000, consequent upon personal injuries sustained in this manner. A statement reader, having taken the figures from a meter, located in the cellar, the entrance to which was from a door to a side porch, emerged from the cellar stairway, passed out the porch, failing to close the door. It was dusk at the time, and Mrs. Lawrence later on had occasion to enter the cellar. Presuming the door was closed, she put out her hand to press back the door, but stepped through the opening, much to her physical injury."

THE Windfall Gas Company, of Eldred, Pa., has been incorporated by Messrs. C. B. Payne, W. H. Cary, Thos. J. and Della Slavin, and E. I. Marsh. The initial capitalization is $20,000.

MR. CONRAD H. SYME, General Counsel, the Public Utilities Commission, District of Columbia, when asked to render an opinion respecting whether or not, under the existing laws regarding the subject, the Washington Gas Light Company could merge with Georgetown Gas Light Company, or *vice versa*, declared decidedly in the negative. Quoting the crux of his decision, he said: "* * * The Georgetown Gas Light Company has no power to sell to, and the Washington Gas Light Company has no power to purchase or use any property or asset of, the Georgetown Gas Light Company, essential to its operations, and that the Public Utilities Commission has, consequently, neither authority, power nor capacity to approve, validate or confirm any such sale or purchase for any purpose whatsoever. To construe * * * the Public Utilities Law as giving to these corporations the power to alienate property essential to their operation, which Congress has withheld, and the general law does not otherwise confer, would require the language of the act to be so explicit to that effect as to need no construction and too plain to necessitate an argument. Such language it does not contain."

WE understand that Mr. R. B. Wagner, of Wagner Brothers, Grand Rapids, Mich., has been in Alma, Mich., in respect of paving the way to installing a gas plant under the ordinances granted last spring to the projectors of the Gratiot County Gas Company. This Company was privileged to supply gas to the villages of Ithaca, St. Louis and Alma, and a fourth prospect was in an adjoining settlement known as Breckenridge. Mr. Wagner, after a thorough inspection or examination of the named territory and its prospects, reported favorably in the premises, and his principals are arranging for the financing of the Company. This arranging has progressed to the point where it may be said the concern will be capitalized in $50,000, and subsequently bonded in $60,000, 30-year, 6 per cent. securities. It is proposed to sell the stock locally at not less than par, the bonds to be sold at a like figure. The estimates for manufacturing and distributing plants foot up $100,000, which will leave $10,000 bonds for the treasury reserve. This plan is all in accordance with the determination of the projectors to turn over to the security holders a complete plant owned by a concern that invested in properties every dollar of the capital subscribed.

WHEN the Boston firm of C. D. Parker & Company recently took over the plant of the Marion (Mass.) Gas Company, it was stated that Mr. B. E. Waters had resigned the dual post of Treasurer Manager, and that Mr. E. P. Rowell, of Plymouth, Mass., would succeed him. Mr. Waters, however, was to act as deputy Manager-Treasurer. The Parker Company issued a public statement say, respecting Mr. Waters' standing with them as to his fitness for Manager, declaring it "Is delighted to say he has agreed to continue in such capacity. Mr. Rowell as a Director will be active in co-operating with Mr. Waters, but will not be Manager."

"MASON," writing from Danbury, Conn., under recent date, incloses this mention: "A feature of the formal opening of the handsome office building of the Danbury Gas and Electric Company was a display of a completely furnished, model, living apartment of 5 rooms, as located on third floor of the building. The apartment comprised 5 rooms—kitchen, pantry, dining room, bedroom and bathroom. The bedroom was fitted with two systems of lighting, semi-indirect in the ceiling and a semi-indirect example of the wall type. The dining room was furnished in the style of Louis XV., the color scheme and furniture being matched. Three systems of lighting were shown in the room, the first type being that of a single, semi-indirect central bulb, surrounded by a cluster of lights flush with the ceiling. For decorative use the room carried the latest thing in gas candelabra. The three systems were so arranged that they could be operated independently or as a unit. The dining room serving-table was so arranged that electric appliances could be operated from the dining room table. The kitchen was fitted with a large nickel-plated gas range, of the cabinet, elevated double oven type, next to which was placed an incinerator or gas destructor, for the doing away with all garbage, without any deposit of ash. Two distinct systems of heating water were shown, one a tank heater, with external application of heat, the other of the storage sort, comprising vertical tank and internal coil, thermostatic valve, porcelain tube, etc. Another feature of the show was an electric fireless cooker, with clockwork device, for the cooking of vegetables and the like in a vacuum. The housewarming lasted several days (of course, competent instructors were on hand to explain everything shown), and it is safe to say that 70 per cent. of the housekeepers of the district inspected the model house at least once."

FOLLOWING the active days-and-nights of the office opening and the housewarming, at Bethel, Conn., the end came in the shape of a banquet, which was served the night of Saturday, December 20th, in the Hotel Green, the hosts being the Company's heads of division. Besides the solid portion of the spread, speeches, music—vocal and instrumental—and clever recitations concluded a most enjoyable evening. Miss Margaret Tomlinson's solos were much appreciated; and Mr. C. E. Meyers, from the pianist's chair, was also heartily encored. The proceedings were under the capable direction of Toastmaster J. W. Rutherford, the diplomatic Manager of the Company's commercial division. Besides the large local representation, the guests included Messrs. William Richards and William Coleman, of Boston.

The Market FOR GAS SECURITIES.

The trading in Consolidated gas last week was small in volume and lacked animation. Nevertheless, the advance reached during the last fortnight in December was fairly well maintained. The opening quotation this morning (Friday) was 130 to 130¼. The Company's plannings on construction account for the year are on a large scale, and the new issue of convertible debentures will, as to proceeds, be none too large to take up outstanding acknowledgments and to pay for the new cost charges. The opening quotations for Consolidated (published January 6th) last year were exactly 10 points over those for this year—140 to 140¼.

Brooklyn Union is also at the quotation of a week ago—121½ to 123; and the first figures for last year were 139 to 144, but, to tell the truth, if it were worth that then 'tis worth more now, intrinsically. Peoples gas more than holds its recent advance, the quotation to-day being 121½ to 121¾. It is on the cards that important changes are to occur in the economies of this huge concern.

The Brooklyn Borough Gas Company has declared its initial dividend, amounting to 3 per cent. It is payable the 20th inst., which to all intent means that it is on a 6 per cent. basis. The Company is offering $125,000 additional stock to shareholders of record, the 31st ult., who are privileged to subscribe in the ratio of 1 to 4 at par. This right expires the 20th prox., and there is little doubt that "rights" will be largely oversubscribed.

The Old Colony Gas Company has declared a quarterly of 1¼ per cent. on the preferred, payable offhand. The Company reports a large increase in business. The Cambridge (Mass.) Company's issue of 1,200 shares (at $200 each) will be ready the 28th inst.; at any rate, the subscriptions thereto are payable that date.

Messrs. H. L. Doherty & Co. are offering the unsold part of 5 millions (total to be issued, $10,000,000), of 5-year, 7 per cent. convertible, coupon gold notes, due May 15, 1918. The price asked is par and interest. These notes are a debt on the Cities' Service Company, and are redeemable at 102, plus interest, at any time on 30 days' published notice.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JANUARY 5.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	130	130¼
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	2,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	101	104
Mutual Gas Co.	8,600,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100¼
New York and East River—				
1st 5's, due 1944, J. & J.	8,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	96	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	121½	123
1st Con. 5's, due 1948, M. & N.	15,000,000	—	105¾	107
Yonkers	999,650	500	130	—
Out-of-Town Companies.				
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Chicago Gas Co. Guaranteed Gold Bonds	7,000,000	1,000	104	106¼
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Cincinnati Gas and Electric Co.	29,500,000	100	67	69
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus Gas Light & Fuel Company	1,682,750	100	65½	66¼
Preferred	3,026,500	100	33	35½
Consolidated, Baltimore	13,460,084		118½	119
Mortgages, 5's	3,400,000		—	—
General Mortgage 4½	10,661,000		—	—
Con. Gas Co., Baltimore City, 4½	2,751,000		—	—
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	130	132
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	85	90
" Bonds, 5's	2,650,000	—	90	93
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	299,000	1,000	97	100
Laclede Gas Co., St. Louis	10,000,000	100	92	96
Preferred	2,500,000	100	—	102½
Bonds	10,000,000	1,000	103½	104
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	89	90
Preferred	25,000,000	100	89	90
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	121¼	120¾
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Pacific Gas and Electric Co.	15,500,000	—	33¾	35
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	8
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
United Gas Imp. Co.	55,502,960	50	167	168

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

Alabama Light and Traction Company.—Annual meeting, May ——1914. Officers, President, R. L. Ellis, Selma; Treasurer and Secretary, H. O. Hanson, Mobile.

American Gas Institute.—Annual meeting, New York, October 21, 22, 1914. Officers: President, W. H. Gartley, Philadelphia. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting————1914. Officers: President, A. A. Dion, Ottawa; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1914. Officers: President, J. T. Hutchings, Rochester, N. Y.; Secretary, C. H. B Chapin, 29 W. 39th street. New York City.

Gas Meters.—Monthly Section Meetings; Grand Commissioner, Will. W. Barnes. East Orange, N. J.; Gen'l Sec'y, H Thurston Owens, La Crosse, Wis.; New York Section, Chairman, W. H. Pettes; Secretary, G. E. Smith, Sipp Avenue, Jersey City, N. J. Philadelphia Section; Chairman, Stanley Grady; Secretary, H. E. Stiteler, Broad and Arch streets. Cleveland Section, Chairman, F. R. Hutchinson; Secretary, Wm. Holtz, East Ohio Gas Co. New England Section, Chairman, T. W. Jennings, Boston; Sec., F. K. Wells, 69 Broad street, Boston. Winona Section, Winona, Minn., W. F. Clausen, Chairman. Bethlehem Section, Trueman Weithnecht, Chairman; Sec.-Treas., Truman Buss. South Bethlehem, Pa. Wisconsin Section, C. H. Wiggers, Chairman; A. A. Ott, Secretary, Milwaukee, Wis.

Guild of Gas Managers of New England.—Annual meeting, March, 1914. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 18th and 19th, 1914. Chicago, Ills. Officers: President, W. F. Barrett, Chicago, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, Cleveland, O., September, 1914. Meetings of Sections, monthly. Pres., Charles O. Bond; General Secretary, J. D. Israel, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March 11 and 12, 1914. Terre Haute. Officers: President, A. S. Cooke, Terre Haute; Vice-President, A. C. Bimn, Evansville; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Davenport, May 27, 28, 29, 1914 Officers: President, B. C. Adams, Lincoln, Neb.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October—— 1914. Arkansas City. Officers: President, Al. Newman, Arkansas City; Secretary and Treasurer, Ivan Thomas, Wichita Kas.

Michigan Gas Association.—Annual meeting, September, 1914. Place, undetermined. Officers: President, H. W. Douglas, Ann Arbor, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1914. Mexico, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting, Dec. ——1914, Minneapolis, Minn. Officers: President, P. S. Young, Newark, N. J.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, St. Louis, Mo., May 19 and 20, 1914; Officers: President, E. L. Brundrett, Kansas City, Mo.; Secy-Treas., T. Clive Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 18th and 19th, 1914. Boston Officers: President, T. H. Hintze, Providence, R. I.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Next Meeting, —— ——, 1914, Asbury Park N. J. President, C. F. Butcher, Freehold, N. J.; Sec'y-Treasurer, O. F. Potter, Newark, N. J.

Ohio Gas Association.—Annual meeting, February ——— 1914 Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, Oklahoma City, May, ——1914. President, F. E. Bowman, Ada; Secretary-Treasurer, H. V. Bozo, Oklahoma City.

Pacific Coast Gas Association.—Annual meeting, Long Beach, Cal., September ——— 1914. Officers: President, C. S Vance, Los Angeles, Cal.; Secretary-Treasurer, Henry B stwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Allentown, Pa., April ———, 1914; Officers, President, J. A. Frick, Allentown, Pa.; secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 11, 1913; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city.

Southern Gas Association.—Annual meeting, Mobile, Ala., April 22, 23, 24, 1914, Officers: President, James Ferrier, Rome, Ga.; Secretary-Treasurer, E. D. Brower, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting, May 22, 23 and 24, 1914. Galveston, Tex. Officers: President, G. H. Gifford, Fort Worth Tex.; Secretary-Treas., J. D. Walker, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 20, 21, 22, 23, 1914, Milwaukee, Wis. Officers: President, Ewald Haase, Milwaukee, Wis.; secretary-Treasurer, Henry Harman, Milwaukee, Wis.